DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
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NORFOLK, VA 23551-2487

5800
Ser N00/200
16 Nov 12

From: Commander, U.S. Fleet Forces Command
To: Chief of Naval Operations

Subj: USS MIAMI (SSN 755) FIRE PANEL RECOMMENDATIONS

Ref: (a) USFF ltr Ser N00/128 of 25 Jun 12

Encl: (1) Executive Summary
(2) List of Priority Recommendations
(3) List of Remaining Recommendations
(4) Draft Letter of Designation for Executive Agency

1. The Miami Fire Panel submitted their report to Commander, U.S. Fleet Forces on 1 October 2012, as tasked by reference (a). The Panel concluded that the Navy was not ready for a fire of this magnitude in an industrial environment. I concur with the findings and recommendations of the report. An Executive Summary of the report that incorporates stakeholder input is included as enclosure (1).

2. Two of the five major contributors outlined in the report are of particular concern. First, it is clear that the Navy has unintentionally accepted a reduced margin to fire safety when a ship enters an industrial environment -- where the risk of fire is at its highest. During shipyard periods, the ship's installed damage control and communications capabilities are stripped and much of the crew is off of the ship, significantly reducing the ship's ability to respond to and extinguish a fire before it spreads. By contrast, at sea we rely on a fully-manned and alert crew, who will quickly find and aggressively attack a fire. Second, there is no single organization accountable for implementing recommendations from fire-related mishaps and lessons learned. This lack of single point accountability has resulted in seams and missed opportunities to put in place measures to increase safety and fire fighting readiness -- measures that may have significantly mitigated the damage to MIAMI.

3. Unlike many mishaps, where a single link in the chain failed after others were weakened, the MIAMI investigation paints a

picture of multiple processes within several organizations going through the motions, with no particular failure, but lacking focused attention and oversight, and missing the mark in the aggregate. With this in mind, in order to increase fire fighting and damage control readiness, meaningful corrective actions must be made in an integrated and coordinated fashion across many organizations.

4. The Panel provided a list of 99 recommendations. U.S. Fleet Forces will coordinate with Commander, U.S. Pacific Fleet to ensure oversight and disposition/implementation of those recommendations requiring action by the Fleet and Type Commanders; however, most of the recommendations require action by commands which do not fall under Fleet Forces' command and control. The 39 recommendations which were evaluated to require the highest priority action are listed in enclosure (2) and are organized in the categories of Fire Prevention, Fire Detection, Immediate Fire Response, and Extended Fire Response. Within those categories, they are further arranged by organization. I intend to review the status of these actions every 60 days. The remaining 60 recommendations listed in enclosure (3) will also improve the Navy's overall fire preparedness and response, but are of a lower priority. I intend to review their status every 120 days.

5. To ensure oversight and disposition/implementation of the corrective actions recommended for the OPNAV staff, Naval Sea Systems Command, Navy Installations Command, Naval Safety Center and others, consistent with the recommendation of the Panel, request you designate Fleet Forces Command as the CNO's Executive Agent for Damage Control Modernization and Improvement, with the authority and responsibility to oversee implementation of Damage Control Modernization and Improvement requirements.

6. A draft letter of designation is included as enclosure (3) for your consideration.

WILLIAM E. GORTNEY

EXECUTIVE SUMMARY

The USS MIAMI (SSN 755) Fire Review Panel was appointed by Commander, U. S. Fleet Forces Command (USFF) and tasked with conducting a comprehensive examination of all aspects of the fire on board MIAMI on 23-24 May 2012 while in dry dock at Portsmouth Naval Shipyard (PNSY). Included in this summary are the inputs from Naval Sea Systems Command (NAVSEA), Commander Naval Installations Command (CNIC), and Naval Reactors (NR). Additionally, an investigation by the Naval Criminal Investigative Service (NCIS) is still underway, and an individual suspected of starting the fire has been charged with arson. The Panel examined circumstances surrounding the fire and the subsequent response, including organizational factors and command and control (C2) issues that may have contributed to the seriousness of the fire and extent of the damage. This effort naturally branched into many other areas that required investigation including:

- Trends associated with other significant shipboard fires and related casualties
- Crew preparations for the industrial environment
- Certification and training of Federal firefighters
- Casualty response
- Command and control
- Damage control doctrine and casualty procedures
- Temporary systems
- Firefighting equipment and associated technologies
- Assessment of MIAMI repair efforts

The fire was of sufficient magnitude, and burned at such high temperatures, so as to necessitate engineering assessments of heat effects on the pressure hull and to require significant rip-out and dismantling of the upper and middle levels of the ship's Forward Compartment (FC). The ship's reactor plant and Engine Room (ER) were not affected. Testing to date has not identified any engineering limitations that would preclude MIAMI's return to a fully operational condition. Although there is no shortage of lessons learned from this event, the crew and Federal firefighters adapted to the conditions of the day. They had not trained for the situation that confronted them, but eventually prevailed in extinguishing a large industrial fire after ten hours of continuous effort involving significant personal risk. Although there were minor injuries, no fatalities occurred.

The Navy has invested and prioritized its efforts in the prevention, detection, and immediate response to shipboard fires in an industrial environment. This has proven successful to date as demonstrated by the excellent fire safety record during shipyard availabilities. However, the Panel concluded that the Navy was not ready for the extended response required for a shipboard fire of the magnitude experienced on MIAMI. Significant progress has been made since the MIAMI fire, but fundamental issues remain unresolved. Two major factors influence this conclusion. First, at multiple levels, prior success contributed to decisions which incrementally reduced our readiness to combat an extended fire. For example, installed Damage Control

Systems are removed or disabled in support of production efficiency. Second, as shipyard production efficiencies were gained, ships were taken to a lower status of damage control readiness with no change in the temporary damage control systems. The unstated pre-MIAMI assumption was that the availability of the Federal fire department mitigated much of this risk in the event an extended fire response were to be required. The consequences of this assumption were compounded by the fact that evidence exists that deliberate actions were taken by an alleged arsonist to set a fire that would fully develop in an unoccupied shipboard area containing combustible material. This action bypassed our defenses of prevention, detection, and immediate response; this scenario was not considered in risk analysis or casualty response preparations. While diligence in the prevention, detection, and immediate fire response are still the key elements in ensuring safety of personnel and the ship, the significant damage to a Navy combatant from an extended fire casualty dictates that we must be better prepared for such a casualty in the future.

Collectively, organizations failed to maintain perspective regarding risk of shipboard fires and missed opportunities to correct this deficiency.

Although there were many contributors, complacency regarding the possibility of a large shipboard fire in an industrial environment was evident in five major areas:

a. **There is no single organization accountable for implementing Navy-wide recommendations from fire-related mishaps and lessons learned.** This lack of accountability includes lessons on DC doctrine, training, and equipment. Compounding this gap, readily available improvements to DC technology compete with other modernization programs. DC equipment modification recommendations from previous fires, forwarded by Safety Investigation Boards and other panels, have not been acted upon or were dismissed by lower echelon decision makers. Navy pipeline firefighting courses, as well as both Fleet and Federal firefighting training programs, are not adequately responsive to significant shipboard fires and lessons learned. Significant recommendations include:

(1) (b) (5)
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b. **Through a series of incremental decisions, the Navy has unintentionally reduced margin to fire safety in a high risk industrial environment.** During maintenance availabilities, the quantity and intensity of welding, grinding, and other hot work add risk. Shipboard DC and communications systems are not operational or are significantly degraded. Temporary systems, lack of watertight doors and ventilation configuration are complicating factors for a crew that is inexperienced with DC in an industrial environment. Doctrine for shipboard firefighting in an industrial environment does not exist. In-hull watchstander and supervisory presence during maintenance availabilities are reduced. All of these factors contribute to a decline of typical risk mitigations on board operational vessels. This is also counter to Navy's firefighting doctrine and safety-based design assumptions, which rely on a fully manned and alert crew to quickly identify and aggressively attack a fire. Much of this fire risk was thought to be mitigated by the presence of Federal firefighters at naval shipyards. This assumption was flawed in that Federal firefighters are not certified or trained to fight fires in a shipboard environment. Significant recommendations include:

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Enclosure (1)

(7) (b) (5)
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c. **Opportunities were missed to improve shipyard fire response readiness.** Programs to improve shipyard/industrial processes appropriately emphasize production efficiency, cost control, and prevention of major casualties. This focus resulted in NAVSEA viewing fire response concerns through an administrative lens, allowing staff processes to handle critical safety issues in a bureaucratic manner. Although identified as early as 2006, many shipyard directives regarding fire response policy do not yet adequately incorporate requirements for integrated plans. Contributing to this, NAVSEA headquarters does not have an adequate mechanism in place to handle the "important, but not urgent" issues. Significant recommendations include:

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d. **On-scene C2 relationships for shipboard casualties requiring outside assistance are not clearly understood.** The relationship between the senior Federal fire officer and the MIAMI Commanding Officer (CO) acting within the National Incident Management System (NIMS) was not clearly understood. As a result, several hours of independent firefighting efforts ensued. During this time, organization and employment of fire teams was disjointed, and ultimately a continuous application of extinguishing agent was not maintained. Significant recommendations include:

(1) (b) (5) [redacted]

(2) TYCOMs update Surface and Submarine CO qualification and training procedures to require training on the role of the CO within NIMS.

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

e. C2 procedures for emergencies on nuclear ships were not well understood by some commands and are not defined for casualties on non-nuclear ships. Not all commands understood that OPNAVINST 3040.5D (Procedures and Reporting Requirements for Nuclear Reactor and Radiological Accidents) is the governing instruction for response to a fire that threatens the reactor or propulsion plant of a U.S. nuclear-powered warship. When the emergency response was determined to fall within OPNAVINST 3040.5D, responsible commands did not ensure that CNIC and the region were properly notified and requested to join the C2 circuits. Contributing to this, the role of CNIC in nuclear propulsion emergency response is not defined. For non-nuclear ships, the lines between reporting of casualties and direction of significant actions are not clear. Navy directives do not specify whether operational reporting chains of command should be used or shore installation command relationships apply. Significant recommendations include:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]
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A number of working groups from NAVSEA, CNIC, and Commander, Submarine Forces (COMSUBFOR) have convened to develop corrective actions from the fire. The Panel was able to observe these working groups and considers their efforts to be positive. Early actions, however, have been sustained by force of leadership and will require structure to maintain their initial momentum.

The issues identified in this report do not apply only to ships in an industrial environment. Many of the findings in this report apply to ships during a normal pier side in-port routine. Improvements recommended by this report will benefit combat readiness and warfighting capability.

The Navy experiences a major fire of comparable magnitude to MIAMI approximately every five years. Without a systemic approach to corrective action, this pattern is likely to continue. The organizational, training, and technology factors contributing to the MIAMI incident encompass a broad problem set for which there is no single or simple answer. With proper focus, commitment and resourcing, a long-term solution is achievable.

LIST OF PRIORITY RECOMMENDATIONS

FIRE PREVENTION

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FIRE DETECTION

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FIRE IMMEDIATE RESPONSE

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FIRE EXTENDED RESPONSE

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LIST OF REMAINING RECOMMENDATIONS

OPNAV

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Fleet Commanders

Fleet Commanders review content and periodicity of training mandated by echelons higher than TYCOMs to ensure COs are not hindered in maintaining focus on the "main thing".

NAVSEA

(1) (b) (5) [redacted]

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TYCOMs

(1) TYCOMs review the justification for temporary off-hull WRs, and the possibility of maintaining temporary shipboard berthing for at least one Duty Officer.

(2) TYCOMs update Surface and Submarine CO qualification and training procedures to require training on the relationship of the CO, Shipyard Commander (NSA), and Federal Fire Chief within NIMS.

(3) TYCOMs assess the adequacy of DC related shipboard training requirements, particularly during major availabilities, to reflect an appropriate emphasis on DC capabilities.

(4) TYCOMs establish qualification standards to mandate that personnel charged with shipboard DC responsibilities demonstrate appropriate knowledge and individual skill prior to any potential casualty response assignments.

(5) TYCOMs coordinate with NAVSEA and CNIC to align applicable directives to establish a requirement for incorporating various casualty scenarios, including worst case conflagration events necessitating Federal and mutual aid F&ES response, into periodic shipboard training programs.

(6) TYCOMs evaluate all reasonable means to improve realism in shipboard fire training.

(7) TYCOMs coordinate with appropriate training commands to evaluate the adequacy of their respective live fire devices versus commercial state-of-the-art trainers. As appropriate, apply modifications and improvements to all live fire devices.

(8) TYCOMs coordinate with appropriate training commands to establish requirements for live fire training curricula to incorporate written and practical examinations, with skill demonstrations assessed with objective grading standards. Additionally, live fire instructors

should participate in professional development activities such as civilian firefighting information sharing forums.

(9) TYCOMs coordinate with appropriate training commands to evaluate the adequacy of their respective live fire course content and execution. Areas which this review should consider for improvement include, but are not limited to:

- Effects of heat stratification
- Impact of heat and water on PPE performance
- High temperature approach tactics
- Fire location identification tactics
- SCBA bottle re-charging
- Re-entry considerations, including fatigue and firefighting rehabilitation
- Student knowledge and skill assessment
- Varying response scenarios
- Course update criteria, including lessons learned

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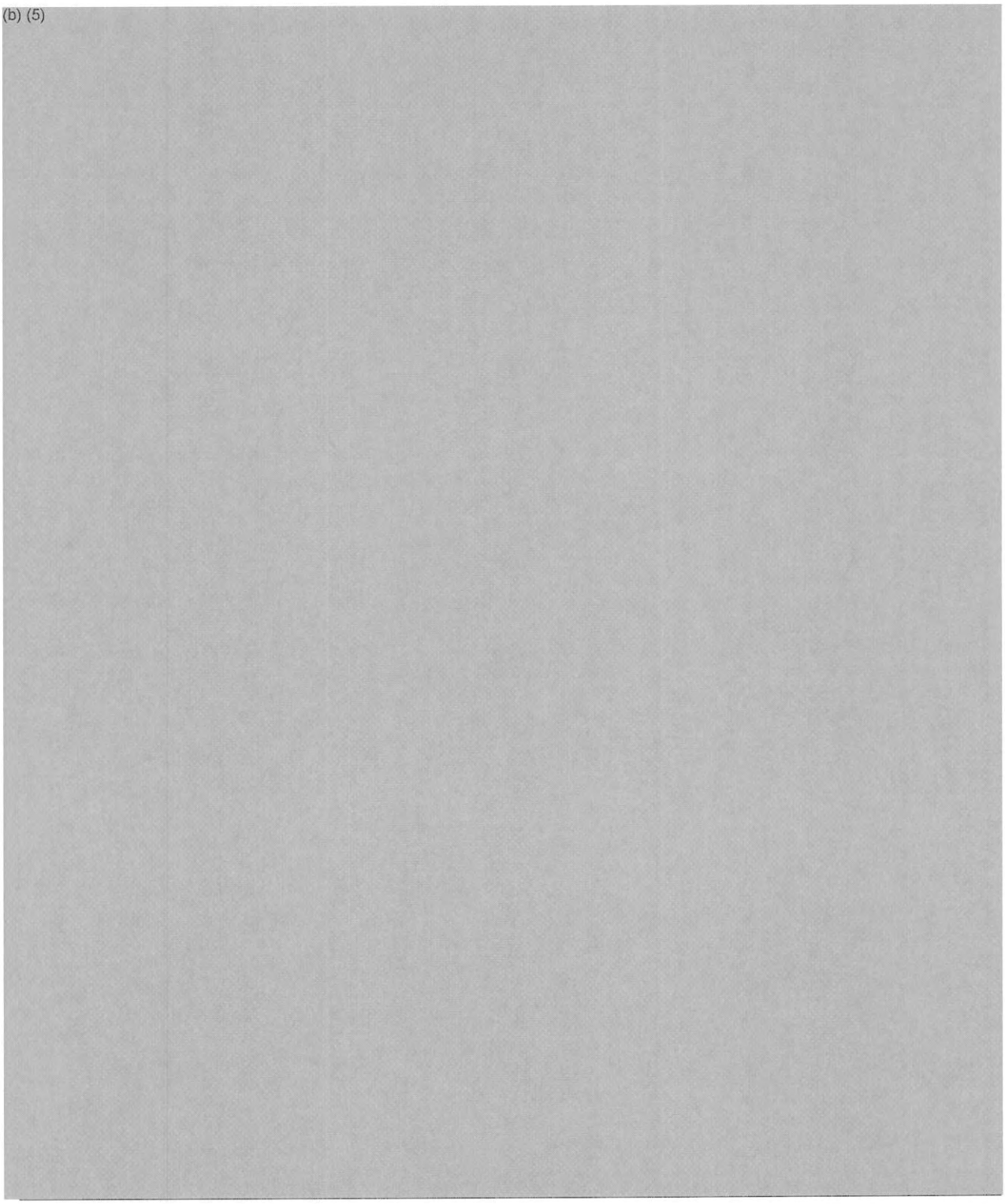
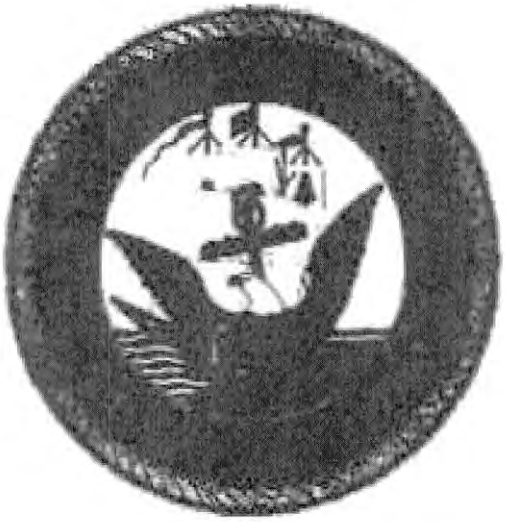


Enclosure (4)

USS MIAMI (SSN 755)
Fire Review Panel



1 October 2012

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This report is submitted as directed by Commander, United States Fleet Forces Command, and provides a summary and in-depth assessment of the factors surrounding the fire onboard USS MIAMI (SSN 755) on 23 May 2012 while in Portsmouth Naval Shipyard.

T. B. Kraft
Rear Admiral, U.S. Navy
Panel Lead

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Panel Member

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Panel Member

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Legal Advisor

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1. EXECUTIVE SUMMARY

The USS MIAMI (SSN 755) Fire Review Panel was appointed by Commander, U. S. Fleet Forces Command (USFF) and tasked with conducting a comprehensive examination of all aspects of the fire on board MIAMI on 23-24 May 2012 while in dry dock at Portsmouth Naval Shipyard (PNSY).[1] An investigation by the Naval Criminal Investigative Service (NCIS) is still underway, and an individual suspected of starting the fire has been charged with arson. The Panel examined circumstances surrounding the fire and the subsequent response, including organizational factors and command and control (C2) issues that may have contributed to the seriousness of the fire and extent of the damage. This effort naturally branched into many other areas that required investigation including:

- Trends associated with other significant shipboard fires and related casualties
- Crew preparations for the industrial environment
- Certification and training of Federal firefighters
- Casualty response
- Command and control
- Damage control doctrine and casualty procedures
- Temporary systems
- Firefighting equipment and associated technologies
- Assessment of MIAMI repair efforts

As of this writing, testing and evaluation is still in progress to determine if the ship's hull can safely operate at submergence pressures. The fire was of sufficient magnitude, and burned at such high temperatures, so as to necessitate engineering assessments of heat effects on the pressure hull and to require significant rip-out and dismantling of the upper and middle levels of the ship's Forward Compartment (FC). The ship's reactor plant and Engine Room (ER) were not affected. Testing to date has not identified any engineering limitations that would preclude MIAMI's return to a fully operational condition. Although there is no shortage of lessons learned from this event, the crew and Federal firefighters adapted to the conditions of the day. They had not trained for the situation that confronted them, but eventually prevailed in extinguishing a large industrial fire after ten hours of continuous effort involving significant personal risk. Although there were minor injuries, no fatalities occurred.

The Panel concluded that the Navy was not ready for a fire of this magnitude in an industrial environment. Significant progress has been made since the MIAMI fire, but fundamental issues remain unresolved. Two major factors influence this conclusion. First, at multiple levels, the success of fire prevention measures contributed to decisions which reduced fire response capacity and degraded readiness. Second, as shipyard production efficiencies were gained, more risk was incurred while shipboard damage control (DC) capability remained static. The unstated pre-MIAMI assumption was that the availability of the Federal fire department mitigated much of this risk. Collectively, organizations failed to maintain perspective regarding risk of shipboard fires and missed opportunities to correct this deficiency.

Although there were many contributors, complacency regarding the possibility of a large shipboard fire in an industrial environment was evident in five major areas:

a. **There is no single organization accountable for implementing Navy-wide recommendations from fire-related mishaps and lessons learned.** This lack of accountability includes lessons on DC doctrine, training, and equipment. Compounding this gap, readily available improvements to DC technology compete with other modernization programs. DC equipment modification recommendations from previous fires, forwarded by Safety Investigation Boards and other panels, have not been acted upon or were dismissed by lower echelon decision makers. Navy pipeline firefighting courses, as well as both Fleet and Federal firefighting training programs, are not adequately responsive to significant shipboard fires and lessons learned. Significant recommendations include:

(1) (b) (5)

(2) (b) (5)

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(3) TYCOMs coordinate with appropriate training commands to evaluate the adequacy of their respective DC and live-fire firefighting course content and execution with respect to recent Fleet lessons learned.

b. **Through a series of incremental decisions, the Navy has unintentionally reduced margin to fire safety in a high risk industrial environment.** During maintenance availabilities, the quantity and intensity of welding, grinding, and other hot work add risk. Shipboard DC and communications systems are not operational or are significantly degraded. Temporary systems, lack of watertight doors and ventilation configuration are complicating factors for a crew that is inexperienced with DC in an industrial environment. Doctrine for shipboard firefighting in an industrial environment does not exist. In-hull watchstander and supervisory presence during maintenance availabilities are reduced. All of these factors contribute to a decline of typical risk mitigations on board operational vessels. This is also counter to Navy's firefighting doctrine and safety-based design assumptions, which rely on a fully manned and alert crew to quickly identify and aggressively attack a fire. Much of this fire risk was thought to be mitigated by the presence of Federal firefighters at naval shipyards. This assumption was flawed in that Federal firefighters are not certified or trained to fight fires in a shipboard environment. Significant recommendations include:

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c. **Opportunities were missed to improve shipyard fire response readiness.** Programs to improve shipyard/industrial processes appropriately emphasize production efficiency, cost control, and prevention of major casualties. This focus resulted in NAVSEA viewing fire response concerns through an administrative lens, allowing staff processes to handle critical safety issues in a bureaucratic manner. Although identified as early as 2006, many shipyard directives regarding fire response policy do not yet adequately incorporate requirements for integrated plans. Contributing to this, NAVSEA headquarters does not have a mechanism in place to handle the "urgent, but not today" issues. Significant recommendations include:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted].

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

(6) (b) (5) [redacted]

d. **On-scene C2 relationships for shipboard casualties requiring outside assistance are not clearly established or understood.** The relationship between the senior Federal fire officer acting as the Incident Commander (IC), defined by the National Incident Management System (NIMS), and the MIAMI Commanding Officer (CO) was not clearly understood. As a result, several hours of independent firefighting efforts ensued. During this time, organization and employment of fire teams was disjointed, and ultimately a continuous application of extinguishing agent was not maintained. Significant recommendations include:

(1) (b) (5) [redacted]
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(2) TYCOMs update Surface and Submarine CO qualification and training procedures to require training on the relationship of the CO and the NIMS IC.

(3) (b) (5) [redacted]
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(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

e. **Higher authority C2 procedures for major non-nuclear casualties on ships in port are poorly defined.** The lines between reporting of casualties and direction of significant actions are not clear. Navy directives do not specify whether operational reporting chains of command should be used or shore installation command relationships apply. The roles and authorities of CNIC's Emergency Operations Centers (EOCs) and Regional Operations Centers (ROCs) are not clearly delineated, creating confusion regarding direction and reporting requirements during the MIAMI fire. Significant recommendations include:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(b) (5) [redacted]

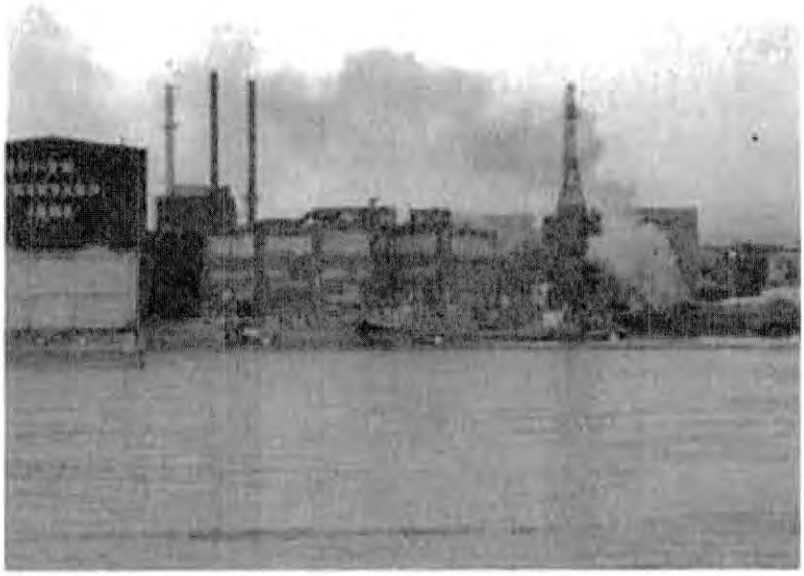
A number of working groups from NAVSEA, CNIC, and Commander, Submarine Forces (COMSUBFOR) have convened to develop corrective actions from the fire. The Panel was able to observe these working groups and considers their efforts to be positive. Early actions, however, have been sustained by force of leadership and will require structure to maintain their initial momentum.

The issues identified in this report do not apply only to ships in an industrial environment. Many of the findings in this report apply to ships during a normal pier side in-port routine. Improvements recommended by this report will benefit combat readiness and warfighting capability.

The Navy experiences a major fire of comparable magnitude to MIAMI approximately every five years. Without a systemic approach to corrective action, this pattern is likely to continue. The organizational, training, and technology factors contributing to the MIAMI incident encompass a broad problem set for which there is no single or simple answer. With proper focus, commitment and resourcing, a long-term solution is achievable.

[1] Miami Fire Panel Tasking letter from USFF

2. FIRE OVERVIEW



USS MIAMI (SSN 755) on the Evening of the Fire

On 23 May 2012, a fire broke out on board USS MIAMI (SSN 755) while in Drydock Number Two at PNSY in Kittery, Maine. A shipyard worker has confessed to starting the fire in Wardroom Stateroom (WRSR) 1 in Forward Compartment Middle Level (FCML). All times are stated in local (ZULU plus four) time.

At approximately 1730 a shipyard worker who had been working in the Torpedo Room (TR) left his work area and entered WRSR1. He located a bag containing rags in WRSR1 and lit them on fire in an attempt to shorten his work day on board the ship. He then went back to work in the TR and waited for the fire to be called away.

Shortly after the fire was started, two shipyard workers noted smoke at the forward end of FCML. They did not immediately announce the casualty but instead traced ventilation piping through Crew's Berthing and noted heavy smoke coming from the WRSR passageway. They could not identify the source of the fire due to the volume of the smoke.

At 1736 a shipyard shop supervisor happened upon the same area and called "Fire Fire Fire!" down to workers in Forward Compartment Lower Level (FCLL), directing them to sound the Casualty Control (CASCON) alarm in the TR.

Both the Ship's Duty Officer (SDO) and Engineering Duty Officer (EDO) were on the living barge at the time of the alarm, and ran to the ship when the fire was announced. Ship's force called the PNSY fire department.

The on-watch Below Decks Watch (BDW), who had just relieved temporarily so the assigned BDW could eat dinner, remained topside and did not respond as required with a portable extinguisher.

The on watch Shutdown Electrical Operator (SEO) and Shutdown Roving Watch (SRW) did respond once they confirmed there was no fire in the ER. They reported to the TR and found no evidence of the fire. They were forced to leave the FC shortly after this due to smoke in the FC.

Based on reports from egressing shipyard workers, at approximately 1741 another crewmember made a CASCON announcement that the fire was in the Wardroom (WR).

At about 1743, the first PNSY fire truck arrived. The Assistant Fire Chief assumed command as the On-scene IC. He directed a pressurized fire hose be deployed from the Engine to the WR via the Weapons Shipping Hatch (WSH), as he had been briefed that the fire was in the WR. Shortly thereafter, after learning that the CASCON alarm had been pulled in the TR, he redirected his hose team to the TR.

At 1744, two ship's force rapid response team members entered the ship via the WSH wearing SCBAs and carrying portable CO2 fire extinguishers. They proceeded through heavy black smoke in FCML with the objective of locating and fighting the fire in the WR. However, they found no flames in the WR. They moved to the TR based on the original casualty location announcement. They were forced to leave the TR due to low air in their SCBAs.

At 1746, the first ship's force firefighting team arrived at the WR with an unpressurized fire hose. The team saw no flames or hot spots in the WR, and proceeded directly to the TR with the hose. At approximately the same time, the first PNSY firefighting team entered the WSH with a pressurized hose enroute to the TR. When this team reached FCLL and discovered no fire, they moved the pressurized fire hose to FCML, outside of the WR.

The SDO reported to the DC stowage locker to don an SCBA in preparation for responding to the fire as the man-in-charge. His response was delayed due to improperly donning his SCBA.

The SDO entered the ship and went to the Crew's Mess, where he announced himself as the Man in Charge. He found the FC filled with heavy black smoke. He knew teams were in the WR, received reports that there was no fire in the WR, and attempted to move to the TR, but could not get there due to personnel blocking access in FCML. He exited the ship via the Forward Escape Trunk (FET) when he received a low pressure alarm on his SCBA.

At about 1750, the Acting Chief of the Boat (COB) entered the ship via the WSH, verified no flames in Forward Compartment Upper Level (FCUL) and then proceeded to FCML to attempt to locate the fire. While in the WRSR passageway he observed indications that fire was near but could not confirm the fire location.

Shortly after 1755, the fire search effort in FCML was hampered due to the entanglement of ship's force and PNSY fire hoses, both of which were routed through the WSH. At no time did any firefighting team report conducting a search for fire in the WRSR area, Officer's Head, or Chief's Quarters. Members of the first ship's force firefighting team began exiting the ship due to SCBA low pressure alarms.

At approximately 1756, the ship's CO arrived and assumed responsibility for coordinating ship's force efforts with the PNSY Assistant Fire Chief, who was the On-scene IC.

Flashover likely occurred in WRSR1 at this point of the casualty.

At approximately 1800, the first extinguishing agent was discharged on board the ship in an attempt to reduce the heat in the WRSR Passageway. The COB obtained a Naval Firefighter's Thermal Imager (NFTI) from a member of an exiting firefighting team and located extreme heat in the WRSR passageway. He then directed a combined ship's force and PNSY firefighting team to discharge the PNSY fire hose into the overhead near WRSR3. Advancing the hose further down the WRSR passageway was not possible due to hose entanglement.

The combined ship's force/PNSY firefighting team near WRSR3 shut the hose nozzle and abandoned the hose after several minutes when their SCBAs began to alarm on low air. There was no relieving hose team on the scene.

Repeated attempts to sustain firefighting efforts were prevented as ship's force and PNSY firefighters continued to run out of air in their SCBAs before being relieved at their locations.

At approximately 1810, the PNSY Fire Chief arrived topside. He relieved the Assistant Fire Chief as On-scene IC at approximately 1819 and reported his relief to the Fire Station dispatch by radio.

At 1821, the Assistant Fire Chief briefed the CO and On-scene IC that there was extreme heat below decks. He reported that the location of the fire was still undetermined and further attempts to access FCML would not be possible via the WSH due to the extreme heat in FCUL.

At approximately 1840, the Assistant Fire Chief and the COB led a firefighting team in routing a 1 ¾" hose from the ER through the Side Passageway Door opening to the FC.

At approximately 1850, the COB reported that there was an active fire in the WR.

Between 1850 and 1933, the fire in the WR increased in intensity. Firefighters were unable to continuously apply water to the fire with the hose routed from the Aft Escape Trunk

(AET) because firefighter SCBAs would alarm on low air before the next relief crew arrived at the hose nozzle. The increased transit time needed to get to the fire through the ER, exacerbated by Federal firefighter unfamiliarity with the layout and specific conditions of the ship limited on-scene longevity of SCBAs.

At approximately 1915, the CO, Project Superintendent, and IC decided to seal all hull cuts and openings and redirect temporary ventilation to push the smoke and heat forward and regain access to the FC via the FET. The CO ordered the hose routed through the AET backed out in order to affix a more resilient barrier to the Side Passageway Door opening.

At approximately 1930, the Project Superintendent identified that charged SCBA bottles were running out and made arrangements to transport expended bottles to the PNSY Fire Station for recharge.

It was not until approximately two hours into the fire when a cogent strategy to gather more resources and more effectively employ them to continuously apply extinguishing agent was formed.

By 2000, the FC was inaccessible due to heat and smoke. At the direction of both the IC and the CO, three 2 ½" sprinkler hoses were simultaneously routed with open nozzles through the Bridge Hatch, the WSH and the FET in order to cool the ship and allow re-entry. The Bridge Hatch fire hose bale was inadvertently shut while being lowered and could not be reopened.

Recognizing that the magnitude of the fire exceeded shipyard resources, the Project Superintendent directed the IC to call all fire departments within 100 miles to respond.

At approximately 2020, the sprinkler hose at the FET was pulled away and the COB led a PNSY firefighting team through that hatch. This team progressed to the WR where they were able to start suppressing the active fire. As additional personnel and equipment were available, the strategy to deploy relieving PNSY firefighting hose teams under escort by ship's force in time to allow an on-scene relief was achieved.

At approximately 2030, PNSY Fire Department requested Submarine Base (SUBASE) New London fire department support. At approximately 2130, a four man team was dispatched from Groton. At approximately 2200, Commander, Navy Region Mid-Atlantic (CNRMA) ROC directed that the four man team return to SUBASE New London. The SUBASE New London Fire Chief and SUBASE CO discussed this, and the SUBASE CO directed the Fire Chief to have his men continue toward PNSY while he consulted with CNRMA.

At 2158, the COB and PNSY firefighters used the 2 ½" hose and an additional 1 ¾" hose that had been routed through the FET to fight the fires in the FCML passageway and the WR.

At 2215, the COB reported that the fires in the WR and the FCML passageway were out. The WRSR passageway and all adjoining WRSRs were too hot to enter, though the COB was

able to proceed to FCUL and verify that active flames existed in Combat Systems Electronic Space (CSES) and in Control.

At 2230, CNRMA directed SUBASE to send a 12 man team to PNSY.

Between 2230 and 0200, firefighting teams made efforts to contain the fires in CSES and Control. Although the fires in these spaces were dampened by hoses and at one point verified to be out, these fires reflashed twice. Firefighting efforts were hindered by the inability to access FCUL via the ladder from FCML just forward of the Radio Room as this access was blocked by temporary services.

At approximately 2353, SUBASE New London Fire Department arrived on scene.

By approximately 0314, there was evidence that firefighting efforts were successful. There were no visible flames anywhere on the ship. Reports confirmed reduced heat, clearing smoke, and that firefighters were knocking down potential hot spots. The fire was under control.

At approximately 0400, two-man fire teams had verified that there were no further hot spots in FCLL and FCML. Hot spot checks in FCUL were in progress, with one hot spot identified in the Radio Room.

At 0550, the fire was out, there were no hot spots, and reflash watches were stationed.

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3. CONTRIBUTING FACTORS

3.1. Organizational Factors

The Panel concluded that the Navy was not ready for a fire of this magnitude in an industrial environment. Although significant progress has been made since the MIAMI fire, fundamental issues remain unresolved. Complacency had set in, based on the infrequency of shipyard fires and relative success of fire prevention measures. Also, there was an assumption that the proximity to far more assets, especially Federal firefighters, reduced the likelihood of a fire not being quickly contained. This organizational reluctance to prepare for a fire of this scale should serve as a wake-up call – large fires can and do happen in industrial environments. Moreover, the experiences and lessons learned from these mishaps apply to ships conducting routine in-port operations, as well as ships at sea. The relevant organizational issues are examined in the paragraphs that follow.

3.1.1. There is no single organization accountable for implementing Navy-wide recommendations from fire related mishaps and lessons learned. The Naval Safety Center (NAVSAFCEN) catalogues lessons learned and recommendations from mishaps. Once the mishap report is transmitted, NAVSAFCEN considers its actions as complete. There is no single advocate or responsible organization to ensure a formal vetting process including systematic tracking of corrective actions through final disposition. This is especially apparent in the areas of DC doctrine, training and equipment, which lack a single cognizant Program Executive Office (PEO) or TYCOM. The Panel's review of other recent mishaps was challenging due to difficulty in obtaining pertinent documents. Safety Investigation Reports (SIRs) contain privileged information, and are not widely accessible, contributing to lessons learned remaining compartmentalized. Command (JAGMAN) Investigations are held by their Convening Authority. After two years, they are required to be forwarded to the Office of the Judge Advocate General (OJAG) for archival. This has not occurred in all cases. This lack of ready access to data surrounding mishap lessons learned contributes to a *sensitivity "half-life"* for major events that typically exceeds the tour lengths of principal decision makers. The Convening Authority moves out on those action items within their purview and forwards the others to higher authority. Recommendations for DC process and equipment improvements typically land at NAVSEA, which has no formal tracking or vetting process for implementing these recommendations unless a particular individual, such as the Commander, champions them. The NAVSEA vetting process for DC equipment is the same as for modernization decisions – there are multiple entities with single point veto authority, and no reevaluation process. Additionally, there is no true Fleet advocate with cross-organizational authority to ensure important DC improvements are properly prioritized and implemented in a timely manner. Although NAVSAFCEN cited participation in a NAVSEA-sponsored DC working group as their principal mechanism for initiating needed change,[2] Panel research revealed this working group has not met since 2006.[3] As a result, no organization or process tracks these issues cradle to grave.

3.1.1.1. Fleet lessons learned have not been incorporated into doctrine and training. An analysis of NAVSAFCEN processes revealed no effective mechanism in place to ensure mishap lessons learned are captured in doctrine or in pipeline and platform specific training. The single largest driver for changes in submarine and surface firefighting training curricula is from Fleet returnee instructors who had familiarity with recent events.

Findings of Fact:

(1) NAVSAFCEN transmits SIRs, but does not track or enforce completion of recommendations.[4]

(2) NAVSEA does not have a formal mechanism in place to track SIR recommendations through disposition. Individual Technical Warrant Holders may take particular items for action as a result of their personal knowledge or involvement, but there is no mechanism for line item NAVSEA consideration of SIR recommendations.[5]

(3) Command Investigations for major fleet casualties are not always submitted for archival as required, limiting their utility in compilation of lessons learned. Command Investigations are to be retained by the Convening Authority for a period of two years, then forwarded to the OJAG for retention as required by Department of the Navy (DoN) Records Management rules.[6] The Panel was not able to obtain copies of several widely publicized fleet mishaps due to improper records retention.

(4) There is no synchronized mechanism implementing lessons learned from fleet mishaps into pipeline, Navy, or platform specific training or doctrine.[7,8,9]

(5) Submarine and surface firefighting training curricula are not routinely updated to reflect fleet lessons learned.[10,11]

Opinions:

(1) (b) (5) [redacted].

(2) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5)
(b) (5)

(3) (b) (5)

3.1.1.2. Methods to ensure continuous modernization of DC processes and equipment are ineffective. Although various organizations such as the Office of Naval Research (ONR) and the Naval Research Laboratory (NRL) are working long-term DC technology improvements, the effort to modernize DC equipment is hindered by the relatively small pool of resources (manpower and money) made available for this task. As an example, the NAVSAFCEN has no personnel assigned to DC. Within NAVSEA 05, a shop that once comprised 25 people now has three. The daily workload of reviewing DC and safety related issues for new ship designs takes up the majority of the staff's time, leaving little time for Fleet training or Fleet readiness issues. Compounding the lack of resources, the path for approval for DC equipment changes is complex, where single organizations or individuals can reject proposals. [13]

Findings of Fact:

(1) NAVSAFCEN has no mechanism in place to see SIR modernization recommendations through to completion.[14]

(2) NAVSAFCEN is not involved in creating Fleet requirements in the areas of DC equipment and doctrine.[15]

(3) Multiple individuals and organizations can disapprove funding or efforts to improve DC processes and equipment.[16,17]

(4) There is no single entity responsible and accountable for safety and DC related processes and equipment.[18]

Opinions:

(1) (b) (5)

(2) (b) (5)

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

3.1.2. Through a series of incremental decisions, Navy has unintentionally reduced margin to fire safety in a high risk industrial environment. Current Navy firefighting doctrine and shipboard DC/communications setups are designed to support an alert crew with a large footprint, capable of quickly discovering and aggressively attacking a fire to keep it from escalating. By contrast, in an industrial environment (and, to a lesser degree, during most in-port availabilities), these assumptions are not valid. Save for a few roving watches the crew is not on the ship, the ship's DC equipment is removed or inoperable, and basic casualty control design elements such as watertight doors and ventilation systems may be inoperable, removed, or incapable of being sealed. The high level of welding, grinding, and other hot work adds risk. Add to this the lack of normal shipboard communications circuits, temporary makeshift DC equipment less familiar to the crew, and the added complexity of multiple temporary systems with no centralized monitoring or control capability, and the stage is set for the MIAMI fire. Maintenance practices evolved over the years to require the simultaneous disabling of all of the ship's installed DC gear and communications to optimize industrial workforce loading, minimize availability time, and keep costs down. This additional risk is considered acceptable on the premise that there are adequate off-ship resources to combat a shipboard fire.

3.1.2.1. There is an increased risk of fire during industrial availabilities. The large amount of welding, grinding and other hot work required in the industrial environment increases the likelihood of fire. NAVSEA considered industrial process improvements aimed at fire prevention (proper covering of adjacent areas, dedicated fire watches, etc.) to be the primary risk mitigator in these cases.[19,20] As recently as 2010, NAVSEA held an internal Safety Summit, which concluded from shipyard trouble report data that their safety strategy for the next two years should focus on electrical safety and safety while working aloft, due to recent shipyard mishaps in both areas. NAVSEA headquarters concluded that Fire Safety did not warrant additional attention at that time, due to what they considered to be success in fire prevention.[21,22]

Findings of Fact:

(1) Available shipboard fire data (shipyard fires requiring response of the Federal Fire Department) is included in Table 1.[23]

(2) At the time of the 2010 internal Safety Summit, NAVSEA leadership determined that fire prevention efforts were working, and that additional emphasis needed to be placed on electrical safety and working aloft safety, as there had been one recent death to a Sailor from electrocution, and three serious injuries from falls.[24]

(3) Using shipyard trouble reports on fires spanning five years, NAVSEA leadership disestablished the standing Fire Safety Working Group in 2010. This assessment was based on a finding that only 16 of 350 shipyard trouble reports over the last five years (at that time) had been fire safety related.[25,26]

(4) NAVSEA does not maintain data detailing an increased investment in fire prevention efforts. [27]

Year	Number of Shipboard Fires				Shipboard Fires Requiring Fire Department Assistance			
	NNSY	PNSY	PSNS	PHNSY	NNSY	PNSY	PSNS	PHNSY
2012	5	4	2	2	0	1	0	0
2011	5	4	1	2	0	0	0	0
2010	2	1	4	1	0	1	1	0
2009	7	2	1	5	1	0	0	0
2008	2	3	5	3	0	1	1	0
2007		7	1	1		0	1	0
2006		5	0	1		0	0	0
2005		5	1	0		1	1	0
2004		3	2	3		1	2	1
2003		4	4	1		2	4	0
2002		1		1		0		0
2001		4		2		0		2
2000		0		4		0		0

Table 1: Shipboard Fires in Naval Shipyards Requiring Federal Fire Department Response, as reported in ESAMS Database by Regional Commanders

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.1.2.2. There is a reduced effectiveness of ship systems during an industrial availability. Depending on the type of availability, ship's DC capabilities and crew's training and readiness may be reduced. The lack of a working fire main, interior communications circuits, watertight doors, and ventilation ducting/flappers were all factors during the MIAMI fire. Engineering of temporary systems and pre-staging of key closures may restore some of these capabilities. When not cost effective, the integrated fire response policy should address the degraded capabilities due to ship's configuration.

Findings of Fact:

(1) The ship's Fire Main was out of service. Three temporary 1 ¾ inch fire hoses were staged topside near each hatch of the ship. The shipyard provided temporary fire hoses with plastic nozzles installed. These were replaced with the ship's installed equipment using standard Navy brass nozzles by the MIAMI crew prior to the fire. There were no temporary fire hoses staged below decks, nor is there a requirement for them.[28]

(2) There were 48 portable CO_2 Fire Extinguishers staged throughout the ship below decks, plus an additional five staged topside. These extinguishers were provided by the shipyard, and were in locations other than the normal at-sea locations for similar equipment.[29,30]

(3) The CASCON system was the only functioning internal communication system on board. There were 21 CASCON stations staged throughout the ship below decks with an additional 13 in the vicinity of the ship and drydock. CASCON provides a pull switch, and one-way transmission capability for a voice report to a speaker box located with the Topside Watch, as well as a printed readout of the station where the alarm switch was activated. It also provides a general announcing circuit function at the remote stations. It

does not activate a direct alarm at the fire station – the Topside Watch must place this call via telephone. [31,32]

(4) Normal ship project planning does not fund or provide for development of closures for hull cuts, open ventilation, or removed watertight doors.[33,34]

(5) Ships are not equipped with two-way radios for interior communications as permanently installed equipment or as part of the availability package.[35]

Opinions:

(1) (b) (5)
(b) (5)

(2) (b) (5)

(3) (b) (5)

Recommendations:

(1) (b) (5)

- (b) (5)
- (b) (5)
- (b) (5)

(2) (b) (5)

- (b) (5)
- (b) (5)
- (b) (5)
- (b) (5)

(3) (b) (5)

3.1.2.3. Response plans are not required to address some of the more likely "worst case" scenarios. As discussed in Appendix A, USS JIMMY CARTER faced failure of the graving dock wall with hull cuts below the waterline while at Electric Boat Shipyard in 2004. USS BONEFISH and ASDS-1 fought fires with fully intact high-energy systems, complicating their efforts. The addition of highly toxic and explosive chemical reactions from ship's batteries, and feeding of the fires from the ship's air and hydraulic systems when joints failed created further challenges. Similarly, when the fire on MIAMI looked like it could not be brought under control, discussions took place regarding options to fill the FC with Aqueous Film Forming Foam (AFFF) or flooding the dry dock to put out the fire. Although these complications remain less likely, they are possible. Plans must address these contingencies and those charged with responding must understand how to deal with them.

Finding of Fact:

(1) With the exception of the GSO (which was updated to reflect these requirements in December 2011), Navy doctrine and shipyard directives do not provide guidance on an integrated Federal firefighter and ship's force response. There is no guidance for combating fires when ships have intact high-energy systems, such as a submarine main storage battery or high pressure air or hydraulic systems. There is no guidance addressing weight and stability issues associated with putting significant quantities of firefighting water into a vessel in drydock. There is no guidance for consideration of extreme measures such as drydock flooding, inerting compartments or filling with AFFF.[38]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]
(b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

3.1.2.4. Shipboard firefighting is not a required core competency for Federal firefighters. Navy implicitly accepts the increased risk of reduced capability DC systems on the premise that professional firefighters are at the ready. This key planning assumption is not sound, as DoD, Navy and CNIC directives do not require Federal firefighters to certify or train to fight fires in a shipboard environment. As a result, Federal firefighters at Navy shipyards or other installations have no meaningful initial training and certification, continuing training or doctrine in place. Of particular concern, there is a wide variation in the capabilities at the private shipyards that service Navy vessels, ranging from intrinsic firefighting capabilities to sole reliance on mutual aid.

3.1.2.4.1. Shipboard/marine environment firefighting is not defined as a core competency for Federal firefighters on naval installations and shipyards. Current DoD, Navy and CNIC directives do not require naval installation Federal firefighters to certify or train on fighting fires in a shipboard environment.

Findings of Fact:

(1) OPNAV/CNIC directives require naval installation Federal firefighters to have competencies in the areas of structural (building) fires, aircraft rescue firefighting (for installations with airfields), and wildland fires. There is no requirement for training or certification for National Fire Protection Association (NFPA) marine environment firefighting. Following the MIAMI fire, a draft change to CNIC directives has been initiated to add this requirement. [39,40]

(2) Navy F&ES follows NFPA standards for civilian firefighters that are considered applicable to Navy firefighting practice.[41]

(3) NFPA 1005 provides the certification standard for professional qualification for marine firefighting by land-based firefighters.

(4) CNIC directives require periodic training for Federal firefighters on 15 duty tasks of NFPA 1405, Training Guide for Land-Based Fire Departments that Respond to Marine Vessel Fires.[42]

(5) (b) (6) [redacted]

(6) As tracked through ESAMS, CNIC requires Federal firefighters to conduct annual "live fire" training in a structural environment, but not in a simulated shipboard environment.[44,45]

(7) Prior to MIAMI, there was no requirement for periodic walkthroughs by Federal firefighters for ships in naval repair facilities.[46] Local access requirements sometimes deny nuclear propulsion plant entry to firefighters who have SECRET security clearances.[47,48]

(8) Private shipyard firefighters are required by contractual obligations to conduct twice a shift walkthroughs of new construction submarines.[49]

(9) Private shipyard firefighters charged with protection of new construction and commissioned Navy vessels are not eligible to pursue or obtain DoD firefighter certifications.[50]

Opinions:

(1) (b) (5)
(b) (5)

- (b) (5)
- (b) (5)
- (b) (5)
- (b) (5)
- (b) (5)

(2) (b) (5)
(b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5)

(b) (5) [redacted].

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

(6) (b) (5) [redacted].

3.1.2.4.2. Recent Navy F&ES consolidations require an increased reliance on support from non-DoD fire departments. Continuous pressure to optimize resources applied toward F&ES has resulted in a number of consolidations and personnel reductions for fire districts in recent years. CNIC and Regional Commanders have mitigated the resultant loss of fire companies through cross-training of existing companies (e.g., instead of having a separate airfield fire company and structural company, one company is now functioning in both capacities). Although this has allowed preservation of expected initial response times, individual installations now have fewer firefighters, typically one or two companies less, than was considered acceptable five years ago.[52] Capability for larger, long response fires is maintained through Memoranda of Agreement (MOA) with local civilian fire departments to provide mutual aid. The external organizations have varying levels of firefighter experience and certification. Some naval installations, due to their lack of proximity to urban areas, depend on volunteer firefighters, further complicating integration of firefighting efforts.

Findings of Fact:

(1) Recent CNIC F&ES resourcing decisions have resulted in reductions of installation firefighters, which is offset through cross-training of remaining companies and agreements for mutual aid with outside civilian firefighting units.[53]

(2) Over 45% of Federal fire response is based on mutual aid from outside entities. Some installations rely on volunteer firefighters for mutual aid. [54]

Opinion:

(1) (b) (5) [redacted].

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.1.2.4.3. Training, certification, and accountability. Current F&ES training objectives reflect "level of effort" vice "results based" training. Similar to Navy General Military Training (GMT), credit is given for attendance, whereas Fleet training emphasizes standards require assessment of knowledge factors and demonstration of practical skills. CNIC and Regional Program Compliance Assessments are administrative in nature, and do not give leadership a meaningful look into a fire department's readiness to combat likely casualties. A regional assessment of the PNSY Fire Department was conducted in October 2011 and found them to be fully ready, despite the department having conducted no live fire training since 2006. Of note, the assessment was still in routing through CNIC at the time of the MIAMI fire seven months later.

Findings of Fact:

(1) Current CNIC training requirements are largely administrative ("level of effort") in nature and do not reinforce development of practical firefighting skills.[55,56]

(2) Regional assessments of installation fire departments are administrative in nature and do not evaluate practical firefighting skills.[57,58]

Opinions:

(1) (b) (5) [redacted].

(2) (b) (5) [redacted].

Recommendations:

(1) (b) (5) [redacted]

(b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

3.1.2.4.4. There is a wide variation in the firefighting capabilities of private shipyards. Their capabilities range from relatively high levels of readiness, such as Electric Boat (EB) Shipyard, to that of small and mid-sized private yards with no intrinsic fire departments, such as Continental and British Aerospace Engineering (BAE) in San Diego. For shipyards engaged in new construction, contracts requiring compliance with new construction standards drive readiness levels on par or above those of naval shipyards engaged only in repair, due to the lack of uniformity of Navy standards (see section 3.1.3).

Findings of Fact:

(1) The EB Fire Department complies with submarine new construction contract requirements, which drive a robust presence for EB firefighters on ships, both new construction and those undergoing repair. [59]

(2) Shipyards engaged in repair and new construction of surface combatants (non-nuclear) rely primarily on outside fire organizations. Repair shipyards include private shipyards such as Continental and BAE in San Diego. For most locations, these private shipyards are in close proximity to DoD facilities and benefit from mutual aid of the local DoD firefighters.[60]

(3) Navy contracts for private shipyards conducting repair of naval vessels do not specify requirements for the means of providing firefighting services.[61]

Opinion:

(1) (b) (5) [redacted]

Recommendation:

(1) (b) (5) [redacted]

(b) (5) [redacted]

3.1.2.5. Shipyard CO as Installation Commander creates oversight challenges. The COs of PNSY and Norfolk Naval Shipyard (NNSY) are unique in that they are also installation commanders. This dual-hatted nature, not unexpectedly, challenges the bandwidth of the officers assigned. With the emphasis on shipyard production and safety, it is not clear that the CO has the available time to put sufficient focus on the types of Base Operating Support (BOS) issues.

Findings of Fact:

(1) CO PNSY did not consider his Fire Chief to be one of his Department Heads. He considered him to work for the Regional Program Director, and did not expect or invite him to routine shipyard DH meetings.[62,63]

(2) OPNAVINST 11320.23F states that the Fire Chief works directly for the Installation Commander.[64] A previous PNSY CO described a direct reporting relationship between himself and the Fire Chief.[65]

(3) CO PNSY delegated all BOS functions to his civilian Base Support Officer, dealing with CNRMA only infrequently.[66,67]

(4) The PNSY and NNSY COs are dual-hatted in nature with responsibility for both production work and installation management.[68]

(5) The PNSY and NNSY COs have no additional personnel assigned to assist with BOS functions, compared to other installations.[69]

(6) The PNSY and NNSY COs' Fitness Reports (FITREPs) are signed by NAVSEA 08, with a concurrent report signed by CNRMA.[70,71]

Opinion:

(1) (b) (5) [redacted].

Recommendation:

(1) (b) (5) [redacted]

3.1.3. Opportunities were missed to improve shipyard fire response readiness. NAVSEA programs to improve shipyard/industrial processes appropriately emphasize production efficiency, cost control, and prevention of major casualties. This focus resulted in NAVSEA leadership viewing fire safety issues through an administrative lens, allowing junior staff

processes to handle critical safety issues in a bureaucratic manner. This approach has existed since late 2006 despite correspondence directly to Commander, NAVSEA, and frequent prompting of his subordinates. Additionally, NAVSEA headquarters does not have a mechanism in place to handle the "urgent, but not today" categories of issues.

3.1.3.1. The complex landscape of industrial safety laws, regulations, directives and requirements is in need of overhaul. This system of directives evolved through the years in a stove-piped manner such that overarching fire safety requirements applicable to all platforms in any industrial availability are different, depending on the type of platform, type of availability, and the status of the ship (pre-commissioning vs. commissioned). As a result, there are numerous gaps and seams that allow for wide variations in casualty response readiness. Although they are generally in alignment on fire safety and fire prevention, these higher level directives are often contradictory and incomplete on many topics, such as fire response policies. As such, these higher level directives create confusion among NAVSEA Shipyard Representatives (NSRs) charged with holding shipyard commanders to standards. As the lower echelon local directives are derived from these higher level requirements, it is not surprising that naval shipyard local instructions on fire response policies are incomplete and inconsistent. The shipyard commander, the ship CO, and NAVSEA are not well served by these directives. A diagram of the hierarchy of directives applicable in a shipyard repair facility is illustrated in Figure 1, below.

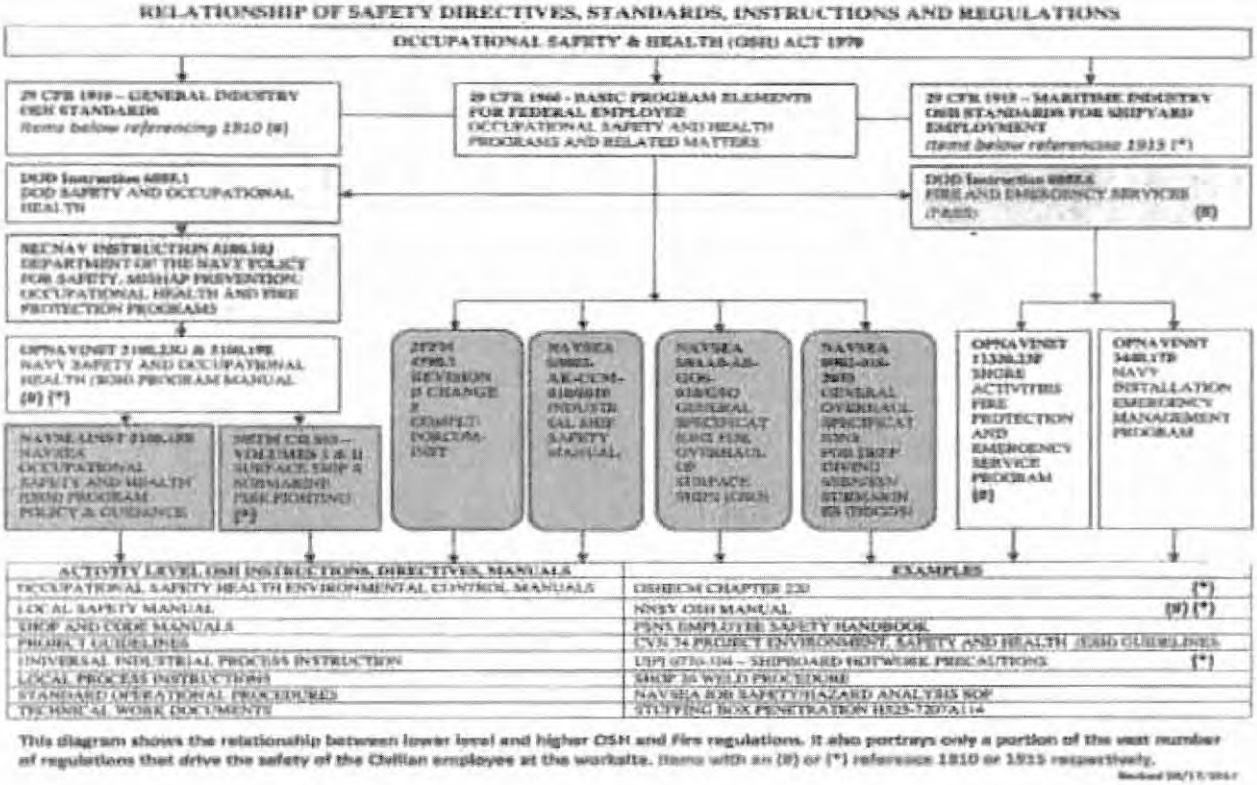

Figure 1: Safety Directives Matrix

Findings of Fact:

(1) Occupational Safety and Health Administration (OSHA) 29 CFR 1915 requirements for integrated fire response policy established in 2004 are not incorporated into the DDGOS. Until December 2011, these requirements were not incorporated into the GSO.[72]

(2) The fire prevention and protection directives for all four naval shipyards and their respective detachments were reviewed. Local shipyard fire response policies are inconsistent and do not incorporate all of the requirements of 29 CFR 1915. Two of the four naval shipyards' (Pearl Harbor Naval Shipyard (PHNSY) and Puget Sound Naval Shipyard (PSNS)) instructions reference many of these requirements.[73,74,75,76,77,78,79]

(3) (b) (5)
(b) (5)

Opinion:

(1) (b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5)

3.1.3.2. NAVSEA headquarters processes for response to inputs from shipyard representatives was not effective in resolving key safety issues and allowing timely action. Despite frequent formal correspondence from one NSR dating back to 2006 concerning firefighting readiness, staffing actions to correct higher authority directives and drive necessary changes to local instructions were not appropriately prioritized. Although NAVSEA working groups were established to examine these issues in 2009, significant findings were not elevated to NAVSEA or CNIC leadership until after the MIAMI fire. Critical changes languished in working group bureaucracy and with senior NAVSEA deputies, with no priority placed on completion. To date, only one higher authority directive (GSO) has been updated as a result of these NSR recommendations.

Findings of Fact:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

(3) (b) (5)
(b) (5)

(a) OSHA rules require a fire safety plan and fire response policy at each geographic location, and that there was not one for each geographic location.

(b) Ship's force and Federal firefighters are not integrated consistent with OSHA rules for an "internal response" to a fire.

(c) Federal firefighters had not incorporated OSHA rules into their response doctrine.

(4) NAVSEA headquarters responded with the formation of a working group, charged with examining the issues and recommending changes to the applicable directives.[86,87] This working group first met on 9 July 2009.

(5) The NAVSEA working group recognized issues with Federal firefighter readiness, and approached the CNIC Director for Navy F&ES (N30) to join their efforts.[88] CNIC N30 agreed to participate.[89]

(6) On 16 October 2009, the CNIC Deputy N30 provided the NAVSEA working group the results of a survey, by region. This survey reported that no regions had updated local fire response policy as a result of the 2004 changes to 29 CFR 1915, as well as other inconsistencies.[90]

(7) The results of this survey were not briefed to CNIC or NAVSEA leadership.[91,92,93,94,95]

(8) Prior to the MIAMI fire, no action was taken by CNIC to update local fire response policy.[96,97,98,99,100]

(9) (b) (5)
(b) (5)

(10) In March 2010, NAVSEA headquarters provided a response to the January 2010 letter. This response indicated that the PSNS local directives were reviewed and that NAVSEA headquarters found them to be "comprehensive and well written."[102]

(11) (b) (5) [redacted]
(b) (5)

(12) The PNSY Fire Safety Manual does not contain guidance for the integration or coordination of Federal firefighters and ship's force. [105]

(13) NAVSEA headquarters does not formally track or assign actions resulting from input from NSR letters to Commander, NAVSEA or from weekly NSR phone conversations with NAVSEA headquarters. [106,107,108,109,110,111]

(14) The PNSY NSR was aware of the concerns raised by the PSNS NSR, and took no action to inform the PNSY Shipyard Commander or to update the PNSY local Fire Response Policies. [112]

(15) NAVSEA headquarters does not formally track or assign actions resulting from input of SIRs. [113]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

(6) (b) (5) [redacted]

3.1.4. Reductions to crew shipboard presence during industrial availabilities require policy modifications or additional mitigations. Over the last several years ship's force personnel have largely migrated off ship while in an industrial environment. Drivers have included the increasing complexity of availabilities, fewer availabilities during the life of the ship causing each to be more intrusive, significant modernization projects effecting habitability of the ship, and concerns over quality of life for the crew. Watchstanding modifications such as combining normal in-port watches, or allowing duty section leadership to work and live off the ship, are clearly warranted given the unique circumstances of the ships conditions, but must be carefully considered in the context of readiness to respond to casualties. In the case of MIAMI, the primary FC roving watch in port (the BDW) was periodically going topside so that the Petty Officer of the Deck could go to the pier to conduct an hourly pier tour and take logs on temporary pier side systems. This hourly pier tour is in addition to having a continuously stationed anti-terrorism/force protection (AT/FP) watch, called the Topside Roving Patrol, whose duties may not include items such as log taking. Relaxations to numbers of in-hull roving watchstanders runs counter to Navy firefighting assumptions of an alert crew finding the fire early and being poised to aggressively attack it before it escalates.

3.1.4.1. Some allowable watchstander modifications result in reduced in-hull presence of roving watchstanders. TYCOM directives allow COs latitude on combining some non-propulsion plant watches. Some of these combinations result in roving watchstanders spending less time below decks. In an industrial environment, for periods with few or no crew members living aboard the ship, COs must carefully consider modifications that may compromise the effectiveness of the few roving watches available. Figure 2 illustrates MIAMI's in-port watch organization.

Finding of Fact:

(1) The CO may approve certain watches to be combined or secured when he or she judges that the ship's operating conditions do not require the complete watch section.[114]

Opinions:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

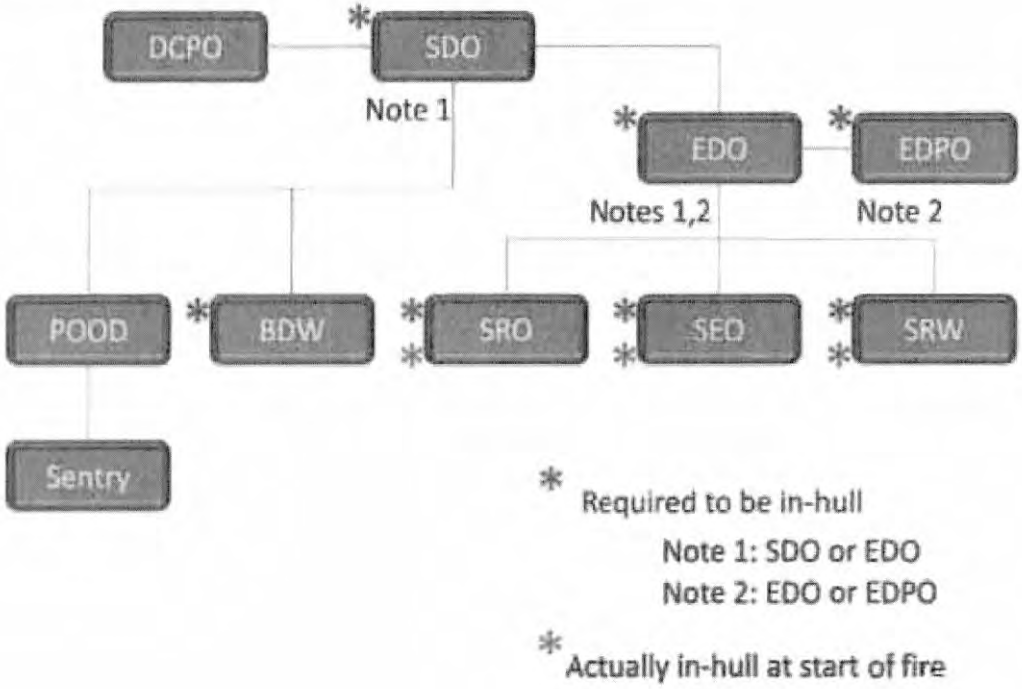

Figure 2: MIAMI In-port Watch Organization

Recommendations:

(1) TYCOMs review directives regarding shipboard watches and minimum shipboard duty section presence during industrial availabilities.

(2) TYCOMs review guidance for modifications to watches that may result in reduced below decks roving presence.

(3) TYCOMs review directives to ensure that the number of roving watchstanders will maintain the required posture for the ship during all circumstances and conditions.

(4) TYCOMs consider providing guidance for adding compartment safety and security check requirements to roving watchstander logs to provide a checklist for thorough hourly compartment tours. COs and watch section supervisors must continuously emphasize the need for thorough tours by roving watchstanders, even to areas with no active ship's systems.

(5) TYCOMs evaluate for an appropriate reduction in shipboard AT/FP posture. With the shipyard being a controlled industrial area (CIA) with its own external security, a reduction to ship's force watch requirements should be considered.

3.1.4.2. Off-hull work control management and living spaces reduced in-hull supervisory presence. An emphasis on production efficiency has driven the justification for off-hull work control management and living spaces for duty section leadership. This results in compromises to normal in port posture in that Duty Officers and Chiefs may be conducting ship's business in an adjacent portable building, and sleeping in a living barge. Even when properly executed, this results in less supervisory situational awareness, fewer opportunities to observe and correct watch team performance, and increased response time should a casualty occur. All three of these issues impacted the fire response on MIAMI.

Findings of Fact:

(1) The MIAMI project utilized an off-hull WR for the conduct of SDO and Duty Chief Petty Officer (DCPO) work control. This was permitted given the state of habitability, berthing, and messing facilities.[115,116]

(2) The MIAMI project utilized a crew living barge, which included accommodations for the SDO, EDO, DCPO and Engineering Duty Petty Officer (EDPO) – all of the Officer and CPO watch team supervisors.[117]

(3) CO, MIAMI issued a temporary standing order which defined that the temporary off-hull WR and certain areas of the pier were constructively considered part of the ship for the purposes of supervisory watchstanding. In this standing order, he provided guidance that the SDO and EDO were not to be on the barge at the same time during normal working hours.[118]

(4) MIAMI had no mechanism in place to ensure either the SDO or EDO were within the defined shipboard boundaries.[119]

(5) Both the EDO and EDPO were on the crew's living barge at the same time, contrary to COMSUBLANT Message 061044ZMAY11 (Z0ZZ), Supervisory Watches with On board Berthing Uninhabitable (Appendix A 06-11).[120]

(6) Both the SDO and EDO were on the living barge at the same time, contrary to MIAMI CO standing orders.[121]

(7) No supervisors were in-hull when the fire initiated.[122]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

Recommendation:

(1) (b) (5) [redacted]

3.1.5. The on-scene command structure for major casualties on ships in port is not established or widely understood by ship COs or Federal Fire Chiefs. During the MIAMI fire, the senior PNSY Fire Officer present (Assistant PNSY Fire Chief) assumed duties as the NIMS IC upon arrival at the ship. The CO was led to believe that PNSY fire department leadership would coordinate firefighting efforts on board the ship. As a result, several hours of independent firefighting efforts ensued. During this time, organization and employment of fire teams was disjointed, resulting in that a continuous application of extinguishing agent was not maintained. For two periods of time (approximately one hour each), no firefighting actions were being taken in hull. These gaps contributed to additional damage and led to the fire reflashing on one occasion.

Findings of Fact:

(1) The NIMS IC is charged with "...overall incident management responsibility." This authority is derived from Presidential Directive, Homeland Security Presidential Directive - 5, of 28 February 2003.[123,124]

(2) Under Navy Regulations, "The responsibility of the CO for his or her command is absolute..."[125]

(3) In response to the staffing referenced in paragraph 3.1.3.2 above, NAVSEA issued ACP 708 to the GSO in December, 2011 which addressed the relationship between the CO and the Federal Fire Department Chief:

> "...the Senior Fire Department (FD) Officer and his party responding to a ship fire will report to the ship's quarterdeck, ask for the Command Duty Officer and advise that he is ready to assist. If the ship desires assistance, the FD officer and his men shall commence operations under the supervision of the ship's Command Duty Officer. The senior member of the FD will make recommendations to the Command Duty Officer concerning all aspects of fighting the fire and will retain direct supervision of his own personnel."[126]

(4) The Command Duty Officer is an officer detailed to a day's duty for the purpose of assuming the CO's duties in the absence of the CO.[127]

(5) On a submarine in port, the SDO fulfills the role of the Command Duty Officer.[128]

(6) Similar language to that described in Finding of Fact (3) was in various stages of draft review for consideration to be added to the DDGOS and NSTM Chapter 555, Volume 2, at the time of the MIAMI fire, but had not yet been issued.[129,130,131] Currently issued versions are silent on the role of the fire department Senior Officer and the CO during fires.

(7) The PNSY Fire Safety Manual states that "The Fire Chief or Senior Fire Officer present during the Fire Chief's absence will be in charge of all firefighting operations."[132]

(8) The PNSY fire department Assistant Chief immediately declared himself to be the IC to ship's force personnel upon arrival at the ship. He was later relieved by the PNSY fire department Chief, and then again relieved as the IC.[133,134]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]
(b) (5)

(5) (b) (5) [redacted]
(b) (5)

Recommendations:

(1) (b) (5) [redacted]

(2) TYCOMs update Surface and Submarine CO qualification and training procedures to require training on the relationship between the CO and the NIMS IC.

(3) (b) (5) [redacted]
(b) (5)

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

3.1.6. A number of issues with operational and reporting lines of authority became apparent during the MIAMI fire.

3.1.6.1. Higher Authority C2 processes for major non-nuclear casualties on ships in port are not adequately defined or codified. The lines between reporting of casualties and direction of significant actions (such as a decision to abandon firefighting efforts, or to flood the drydock) are not clear. Navy directives do not specify if operational reporting chains of command should be used or shore installation command relationships apply. The roles and authorities of CNIC's EOCs and ROCs are not clearly defined. The result was confusion regarding direction and reporting requirements during the MIAMI fire.

Findings of Fact:

(1) OPNAVINST 3440.17 of 22 Jul 05 defines the Navy Emergency Management (EM) system, and charges CNIC with the authorities and responsibilities to develop and sustain a comprehensive EM program at regions and installations. The installation's non-nuclear EOC is part of this program. The cited instruction specifically indicates that it does not apply to nuclear reactor accidents and incidents, nor does it apply to mobile, expeditionary, afloat, or other deployable forces. The instruction specifically requires CNIC to operate within the NIMS framework.[137]

(2) OPNAVINST 3040.5D of 19 May 03 defines procedures and chain of command for reporting and direction of responses to nuclear reactor accidents or radiological accidents associated with the NNPP. It establishes a clearly defined reporting and direction response framework, with robust C2 procedures and plans.[138]

(3) There is no system analogous to the procedures of OPNAVINST 3040.5D for non-nuclear ships.[139]

(4) OPNAVINST 30450.5D does not include CNIC, regional or installation commanders in the C2 path, nor are they included in the C2 communications bridge circuits.[140]

(5) During the MIAMI fire, the CNRMA ROC directed that dispatched SUBASE New London Fire Department personnel return to their base.[141,142,143]

(6) During the MIAMI fire, a Naval Nuclear Propulsion Plant emergency was declared to allow invoking the rules, command structure and communications protocols of OPNAVINST 3040.5D, and activation of the Radiological Emergency Response Organization Emergency Control Center (ECC).[144]

(7) Activation of the ECC gave the local scene authority to overrule CNRMA ROC direction for the SUBASE New London to provide assistance.[145]

(8) With current directives, there is no ECC-equivalent organization for locations that support only conventionally powered naval vessels.[146]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]
(b) (5)

(3) (b) (5)
(b) (5)

(4) (b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

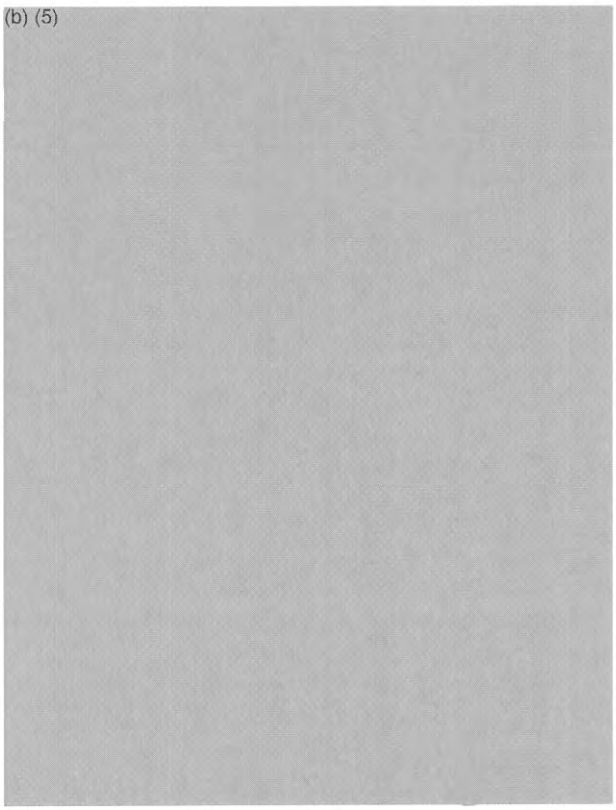

Figure 3: Recommended Incident Response Command and Control

(b) (5)

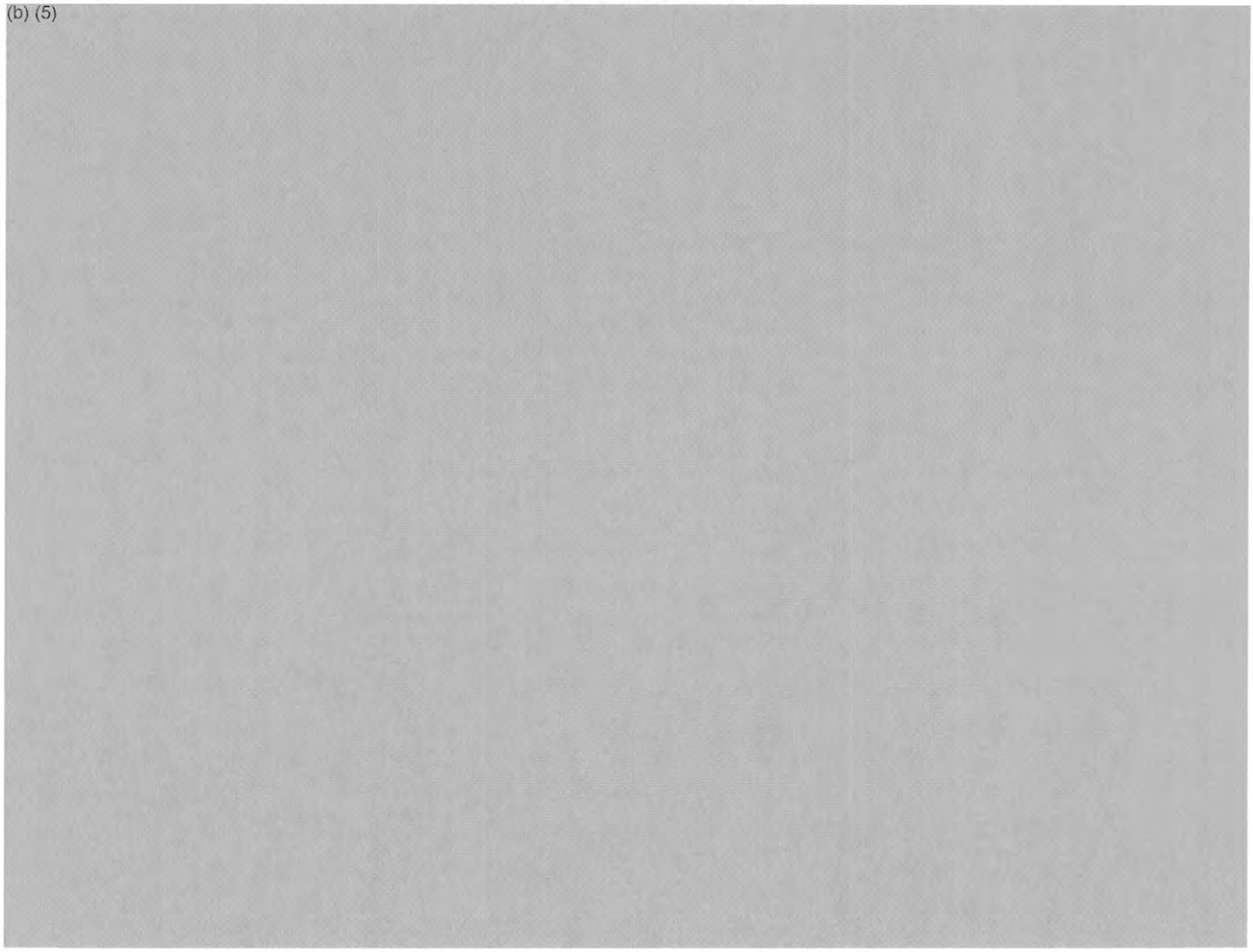

Figure 4: Recommended Incident Response Command and Control with Associated Support Functions and Reporting Requirements

3.1.6.2. There is no real-time Navy wide C2 communications bridge circuit for coordination among the local on-scene commander, operational commanders and NAVSEA/CNIC/CNR/TYCOMs. Use of the Naval Reactors (NR) C2 communications bridge by senior Navy leadership allowed for timely and effective communication between all key decision makers and became the primary means of information sharing, decision making and strategic communication during the MIAMI fire.

Findings of Fact:

(1) The Reactor Accident/Incident Procedure for the NNPP provides for a clear, easily understood and effective C2 bridge communication circuit.[151]

(2) There is no equivalent communications bridge for handling non-NNPP Navy-wide incidents.[152]

(3) During the early stages of the MIAMI fire, cell phones and Blackberry emails were used to relay communications from the ship to both the ECC and EOC, as well as to various levels of leadership.[153]

Opinions:

(1) (b) (5)
(b) (5)

(2) (b) (5)

Recommendation:

(1) (b) (5)

3.1.7. (b) (7)(C)

Findings of Fact:

(1) (b) (7)(C)

(2) (b) (7)(C)
(b) (7)(C)

(3) (b) (7)(C)

(4) (b) (7)(C)
(b) (7)(C)

(5) (b) (7)(C) [redacted]

(6) (b) (7)(C) [redacted]
(b) (7)(C) [redacted]

(7) (b) (7)(C) [redacted]

(8) (b) (7)(C) [redacted]

Opinion:

(1) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

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[2] Memorandum for the Record: Naval Safety Center Visit, 31 July 2012
[3] E-mail from (b) (6) [redacted], 2 August 2012
[4] Memorandum for the Record: Naval Safety Center Visit, 31 July 2012
[5] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[6] JAGINST 5800.7F, 26 June 2012
[7] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[8] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[9] Memorandum for the Record: Afloat Training Group (ATG), Norfolk Site Visit, 27 August 2012
[10] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[11] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[12] OPNAVINST 5102.1D Ch-2 Defines Class 'A' mishaps when total cost of damages to DoD or non-DoD property in an amount of $2 million or more; a DoD aircraft is destroyed; or an injury and/or occupational illness result in a fatality or permanent total disability.
[13] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[14] Memorandum for the Record: Naval Safety Center Visit, 31 July 2012
[15] Memorandum for the Record: Naval Safety Center Visit, 31 July 2012
[16] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[17] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012

[18] Memorandum for the Record: Naval Safety Center Visit, 31 July 2012
[19] NAVSEA Visit Major Takeaways, 23 August 2012
[20] Memorandum for the Record: Interview with (b) (6) and (b) (6) 5 September 2012
[21] Memorandum for the Record: Interview with and 5 September 2012
[22] NAVSEA Visit Major Takeaways, 23 August 2012
[23] Email from (b) (6) 4 September 2012
[24] NAVSEA Visit Major Takeaways, 23 August 2012
[25] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[26] Memorandum for the Record: Interview with (b) (6) and (b) (6) 5 September 2012
[27] Email from (b) (6) 4 September 2012
[28] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[29] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[30] E-mail from (b) (6) (PNSY Code 355), 12 September 2012
[31] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 29 August 2012
[32] USS MIAMI SPOD, 28 August 2012
[33] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[34] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[35] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[36] Shipyard Safety Manager Training Summary, provided during 29 August 2012 PNSY Visit
[37] CTM for Submarines
[38] Memorandum for the Record: Doctrine Review, 24 September 2012
[39] OPNAVINST 11320.2F Ch-2
[40] OPNAVINST 11320.2G (Draft)
[41] Memorandum for the Record: CNIC Visit, 24 August 2012
[42] Email from (b) (6) including ESAMS excerpt, 10 Sep 12
[43] ESAMS records from PNSY Fire Department, JAGMAN Enclosure 62
[44] Memorandum for the Record: CNIC Visit, 5 September 2012
[45] Email from (b) (6) and ESAMS excerpt, 10 Sep 12
[46] Memorandum for the Record: Interview with (b) (6), 1 August 2012
[47] Memorandum for the Record: Interview with (b) (6), 1 August 2012
[48] Email from (b) (6), 21 September 2012
[49] Memorandum for the Record: Electric Boat Fire Department Visit, 31 August 2012
[50] Memorandum for the Record: Electric Boat Fire Department Visit, 31 August 2012
[51] Memorandum for the Record: Electric Boat Fire Department Visit, 31 August 2012
[52] Memorandum for the Record: CNIC Visit, 24 August 2012
[53] Memorandum for the Record: CNIC Visit, 24 August 2012
[54] Memorandum for the Record: CNIC Visit, 5 September 2012
[55] Memorandum for the Record: PNSY Firehouse Visit, 20 July 2012
[56] ESAMS records from PNSY Fire Department, JAGMAN Enclosure 62
[57] Memorandum for the Record: PNSY Firehouse Visit, 20 July 2012
[58] Memorandum for the Record: CNIC Visit, 24 August 2012
[59] Memorandum for the Record: Electric Boat Fire Department Visit, 31 August 2012
[60] Email from (b) (6) CNRSW, response to CNIC SER 001, 28 August 2012
[61] Email from (b) (6), CNRMC, 20 SEPT 2012
[62] (b) (6) response to Panel Questions, 7 August 12
[63] Memorandum for the Record: Interview with (b) (6) 13 August 2012
[64] OPNAVINST 11320.23F Duty Description
[65] Memorandum for the Record: Interview with (b) (6), 6 September 2012
[66] (b) (6) response to Panel Questions, 7 August 12
[67] Memorandum for the Record: Interview with (b) (6), 13 August 2012
[68] (b) (6) response to Panel Questions, 7 August 12
[69] (b) (6) response to Panel Questions, 7 August 12
[70] (b) (6) FITREP from NAVSEA 08, 1 August 2010 - 31 July 2011

[71] (b) (6) FITREP from CNRMA, 1 August 2010 - 31 July 2011
[72] (b) (6) Letter to (b) (6) 15 May 2009
[73] NAVSHIPYDNORINST 11320.4E CH-1, 15 July 2003
[74] NAVREGNWINST 11320.2, 20 October 2011
[75] NAVSHIPYDPUGETINST P1130.1F CH-10, 28 June 2007
[76] PSNS&IMFINST 11320.14, 6 June 2012
[77] NAVSHIPYD&IMFPEARLINST 11320.5M, 12 July 2012
[78] NAVSHIPYDPTSMHINST 11320.6G CH-3, 28 April 2011
[79] PNSDETSDINST 11320.1, 23 October 2009
[80] Memorandum for the Record: Interview with (b) (6), 6 September 2012
[81] Letter from (b) (6) to Commander, NAVSEA, 17 Nov 2006
[82] Email from (b) (6) to (b) (6), 15 Jul 2008
[83] Letter from (b) (6) to Commander, NAVSEA, 25 Jul 2008
[84] GSO ACP 696 approval, 15 Jan 2009
[85] (b) (6) Letter to (b) (6) 15 May 2009
[86] Email from (b) (6) announcing IPT, 9 July 2009
[87] Memorandum for the Record: Interview with (b) (6) 6 September 2012
[88] (b) (6) email 14 Jul 2009
[89] (b) (5) email 16 July 2009
[90] (b) (6) email 16 Oct 2009
[91] Memorandum for the Record: Interview with (b) (6) 5 September 2012
[92] Memorandum for the Record: Interview with (b) (6), 6 September 2012
[93] Email from (b) (6) 11 September 2012
[94] Memorandum for the Record: Phone Interview with (b) (6) 13 September 2012
[95] Email from (b) (6), 11 September 2012
[96] Memorandum for the Record: Interview with (b) (6) 5 September 2012
[97] Memorandum for the Record: Interview with (b) (6), 6 September 2012
[98] Email from (b) (6) 11 September 2012
[99] Memorandum for the Record: Phone Interview with (b) (6) 13 September 2012
[100] Email from (b) (6) 11 September 2012
[101] Letter from (b) (6) to Commander, NAVSEA, 22 Jan 2010
[102] E- mail from (b) (6) r to (b) (6), 10 Mar 2010
[103] Memorandum for the Record: Interview with (b) (6) 6 September 2012
[104] Memorandum for the Record: Interview with (b) (6) and (b) (6) 5 September 2012
[105] NAVSHIPYD PTSMHINST 11320.6G Ch-3, 28 April 11
[106] Memorandum for the Record: Interview with (b) (6) 6 September 2012
[107] Memorandum for the Record: Interview with (b) (6) 5 September 2012
[108] Memorandum for the Record: Interview with (b) (6) 6 September 2012
[109] Memorandum for the Record: Phone interview with (b) (6), 11 September 2012
[110] Memorandum for the Record: Phone interview with (b) (6), 12 September 2012
[111] Memorandum for the Record: Phone interview with (b) (6), 12 September 2012
[112] Memorandum for the Record: Phone interview with (b) (6), 11 September 2012
[113] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[114] Standard Submarine Organizational and Regulations Manual (SSN), COMSUBFORINST 5400.39A
[115] Submarine Shipyard Availability Manual (SSAM)
[116] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[117] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[118] USS MIAMI Commanding Officer's Standing Orders
[119] Memorandum for the Record: Interview with (b) (6), 18 July 2012
[120] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[121] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
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[155] NCIS Investigation: PNSY, Portsmouth, NH / Suspicious Fire at USS MIAMI (SSN 755) Dry Dock #2
[156] Email from (b) (6), PNSY Security Department, 13 September 2012
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3.2. Training Factors

Shipboard DC doctrine is predicated on having a highly skilled, precisely trained, and rapidly deployable response force available to act without delay for the necessary duration to terminate a casualty. Following this premise, a Naval vessel's best chance to limit the spread of a major in-port fire is to ensure a seamlessly integrated team of ship's force, Federal firefighters, and mutual aid responders, as appropriate, responds to the casualty. During the MIAMI incident firefighting efforts were initially disjointed and firefighters did not possess sufficient knowledge, skill, or confidence to tackle the task at hand.[162] Had events unfolded differently, these shortcomings may have resulted in additional property damage, serious injuries, or fatalities. In considering these essential capabilities, and the training issues that led to the performance on board MIAMI, the Panel found it impossible, as a practical matter, to separate training factors from those associated with the doctrine upon which Navy education has been successfully founded. Therefore, this section of the report is aligned with themes identified and discussed in the Organizational Factors section.

3.2.1. Integrated casualty response to the MIAMI fire was lacking. Prior to the MIAMI fire, there was a general assumption among Naval Shipyard personnel that once alerted to a significant shipboard fire, Federal firefighters would arrive, bringing relevant expertise and robust equipment to bear. Under the PNSY fire response policy, Federal firefighters would relieve ship's force rapid response teams in a manner that would bring the situation under control. There was little objective evidence supporting this premise, as integrated training and drill performance standards had not been effectively assessed.[163,164,165] Crew training, Federal firefighter training, firefighting doctrine, and integrated casualty preparedness each played a role in the manner in which events unfolded.[166,167]

3.2.1.1. Training did not adequately prepare the MIAMI crew for a major industrial shipboard fire. Although MIAMI complied with all training requirements prior to the fire, the net product of their qualifications, continuing training, and proficiency programs did not prepare them for the task at hand.

Findings of Fact:

(1) After receipt of the fire alarm, MIAMI's SDO entered the submarine as man-in-charge wearing only a Navy working uniform (NWU) and a SCBA. Although he was a graduate of both the basic and advanced submarine firefighting courses, he took an excessive amount of time to properly don and activate his SCBA and proceed in hull. Eventually gaining access to the ship, he encountered darkness, heavy black smoke, and personnel congestion. As a result, he became anxious and confused, failed to establish himself as man-in-charge and did not successfully redirect firefighting that was occurring at incorrect locations. Initial response by the SEO, SRW, and BDW were similarly repulsed by heavy smoke and limited visibility. None of these watchstanders were able to locate the seat of the fire or apply any extinguishing agent.[168]

(2) MIAMI's SDO attempted a second entry into the ship outfitted in the same manner as his first ingress to assume duties as man-in-charge. As he approached the ship's WSH, the SDO encountered a fully-equipped Federal firefighter hose team and the ship's Executive Officer, who was wearing full PPE. Upon questioning the hose team, the SDO was informed that Federal firefighters would not enter the submarine because they didn't know how to proceed to the reported fire location. After consultation with the Executive Officer, the SDO persuaded the hose team to follow him into the ship. When a hot staircase handrail pushed his NWU blouse above his waist, the SDO sustained an abdominal burn that forced him to exit the submarine and abandon the hose team.[169,170]

(3) During initial and subsequent attacks against the MIAMI fire, numerous practices contrary to doctrine for effective fire attack were employed by ship's company and Federal firefighters. While heat, limited visibility, and general confusion make it unclear exactly which individuals were responsible for specific errors, many mistakes occurred. These include, but are not limited to, advancing on a fire with an uncharged hose, abandoning charged hoses, crossing and tangling hoses during routing and faking, incomplete thermal imaging searches, and ineffective communications.[171,172,173]

(4) MIAMI's non-nuclear overhaul training was prescribed by the submarine TYCOMs' Continuing Training Support Software (CTSS), which is intended to provide submarines a singular source training requirements list. CTSS includes training requirements known as "mandatory events" that, consistent with Industrial Ship Safety Manual for Submarines ("6010 Manual") requirements, prescribe a fire drill at the start of the availability. Additional TYCOM prescribed industrial availability casualty response training is left to the discretion of the CO and his immediate superior in command (ISIC). There are approximately 50 additional CTSS mandatory events directed by higher echelon commands not directly related to casualty or overhaul preparedness. For the most part, MIAMI was in compliance with CTSS requirements.[174,175]

(5) Submarine personnel are normally assigned DC responsibilities based on watchstation. Non-nuclear enlisted submarine accession training (known as Basic Enlisted Submarine School) and TYCOM continuing training both require DC knowledge and skill assessment. However, prior to MIAMI's fire and the submarine TYCOM's recent upgrade to CTSS, submarine watchstation qualifications did not require demonstrations of DC skills.[176,177]

Opinions:

(1) (b) (5)

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

Recommendations:

(1) TYCOMs assess the adequacy of DC related shipboard training requirements, particularly during major availabilities, to reflect an appropriate emphasis on DC capabilities.

(2) Fleet Commanders review content and periodicity of training mandated by echelons higher than TYCOMs to ensure COs are not hindered in maintaining focus on the "main thing".

(3) TYCOMs establish qualification standards to mandate that personnel charged with shipboard DC responsibilities demonstrate appropriate knowledge and individual skill prior to any potential casualty response assignments.

3.2.1.2. Training did not adequately prepare the PNSY Federal firefighters for a major industrial shipboard fire. Similar to MIAMI's crew, Federal firefighter performance was inadequate and reflected a need for fundamental review of DoD's certification and training policies.

Findings of Fact:

(1) Federal firefighters generally obtain initial NFPA compliant certifications prior to being hired. These certifications may be acquired at civilian schools. With few exceptions, there are no requirements for follow-on action to demonstrate proficiency once an initial certification is received. This practice differs from Fleet qualification, certification, training, and proficiency norms.[178]

(2) Naval Installation Federal firefighters document their F&ES continuing training with ESAMS. ESAMS reflects a composite list of all CNIC required training topics for naval installation Federal firefighters. Review of the PNSY ESAMS account for 2012 revealed an extensive schedule of topics ranging from basic knowledge of SCBAs to back injury prevention and hearing conservation. As discussed in section 3.1.2.4.1, ESAMS requires training on 15 elements of NFPA 1405 related to marine firefighting. The ESAMS database only contains the last performed entry for each element, vice retaining a historical record of training.[179,180,181]

(3) The PNSY firehouse training officer position had been vacant for approximately eight months prior to the MIAMI fire due to the incumbent's retirement and the shipyard's inability to hire a suitable replacement.[182]

(4) Most ESAMS periodic training requirements do not require knowledge assessment or skill demonstration. The PNSY Fire Chief indicated most of his firehouse's training consisted of lectures, with little or no assessment of knowledge or skill. He also indicated his presence was sporadic and not considered a requirement for firehouse training to occur.[183]

(5) Fighting a submarine main storage lead acid battery fire with water as the extinguishing agent can result in a violent explosion. Even though the fire was initially reported in the vicinity of the main storage battery, there was no consideration by Federal firefighters to combat the MIAMI casualty with any agent other than water. Although the battery was removed for replacement, the Federal firefighters did not know, nor did they request battery status.[184,185]

(6) Position descriptions for most subordinate PNSY Federal firefighters require detailed knowledge of design, construction, utilization, and contents within submarines. Supervisory position descriptions do not require this knowledge.[186]

(7) Although Federal firefighters are required to participate in a wellness program and comply with specified physical fitness standards upon entry, there is no requirement for further physical conditioning or training after hiring. Personnel who fought the MIAMI fire reported stamina and conditioning as key factors in SCBA expenditure time, rehabilitation between entries, and number of entries attempted prior to physical exhaustion or de-hydration.[187,188,189]

Opinions:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

(4) (b) (5)

(b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5) [redacted]

3.2.1.3. Training did not adequately prepare PNSY shipyard workers to properly respond to an industrial shipboard fire. Actions by PNSY shipyard workers discovering smoke in MIAMI's FCML created confusion among casualty responders and contributed to the severity of the fire.

Findings of Fact:

(1) Upon smelling smoke in the FCML, PNSY shipyard workers initially traced ventilation ducting in an attempt to locate the source of the smoke. No alarm was sounded during this effort. A CASCON fire alarm was not sounded until a PNSY supervisor in FCML noted smoke and yelled, "Fire, Fire, Fire".[190]

(2) Despite the fact that PNSY shipyard workers knew the location of the MIAMI fire was in the vicinity of the WR, the TR CASCON alarm was sounded by workers in the TR upon hearing the announcement by the PNSY supervisor in FCML. As a result, the SRW and SEO both initially responded with CO2 fire extinguishers to the TR.[191]

(3) PNSY shipyard workers with knowledge of the source of the MIAMI fire evacuated the ship and returned to their shop without providing any information to ship's force.[192]

Opinion:

(1) (b) (5)

- (b) (5)
- (b) (5)
- (b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5)

3.2.1.4. Shipboard firefighting doctrine does not effectively support an integrated response or firefighting in an industrial or pier side environment. Shipboard and naval installation firefighting doctrine at the time of the MIAMI fire consisted of a complex, duplicative, and often contradictory collection of disparate manuals and instructions.

Findings of Fact:

(1) Firefighting doctrine applicable to ship's force is under the cognizance of NAVSEA and includes the Ship Systems Manual Casualty Procedures and NAVSHIP Technical Manuals. Firefighting doctrine for civilian firefighters is based on NFPA standards.[193,194]

(2) In addition to NAVSEA doctrine and NFPA standards, a significant number of additional instructions were applicable to personnel responding to the MIAMI fire. These included, but were not limited to, CNO Shore Activities Fire and Emergency Response directives, PNSY Fire Safety Manual, PNSY firehouse standard operating procedures, USS MIAMI CO Standing Orders, and local MIAMI firefighting instructions. Within other Navy regions, regional fire protection directives might also have applied.[195,196,197,198]

(3) NAVSEA doctrine directs a crew in port to inform the local fire department in case of a fire. This doctrine does not specify the manner by which fire departments integrate with ship's company, nor does it address the manner by which integrated firefighting should occur.[199]

(4) NAVSEA's class specific submarine fire casualty procedures direct unaccompanied individuals to take action in affected spaces during the early stages of a fire. Other segments of NAVSEA doctrine direct the use of a two-person rule while combating fires. During the MIAMI fire, several members of the crew performed unaccompanied ship ingress. None of these responders was tracked by a formal accounting system. One individual was injured during ingress and struggled to extricate himself from the ship.[200,201,202]

Opinions:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

(4) (b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5) [redacted]

3.2.1.5. In port/shipyard shipboard fire drills do not incorporate worst case conflagration scenarios and exercise integrated response. Lack of integrated casualty preparedness limited opportunities to recognize incompatibility in procedures, firefighting tactics, and communications, and contributed to the Federal firefighter's unfamiliarity with the shipboard environment during the MIAMI fire. Post-MIAMI drill record reviews at other shipyards revealed the same deficiency. Additionally, doctrine and training regarding finding the seat and advancing on the fire differ between ship's force and Federal firefighters. These items might have been identified and resolved through a more robust integrated casualty training program.

Findings of Fact:

(1) The principal metric for success or failure of a PNSY shipboard fire drill was the time required for Federal firefighters to arrive on scene with an uncharged fire hose. As a result, most fire drills lasted less than 30 minutes, none required an individual to activate SCBA air or pressurize a fire hose, limited integration with ship's force was exercised, and mutual aid response from nearby civilian fire houses was never requested. A similar fire drill practice was found to exist at other naval shipyards.[207,208]

(2) Responsibility for the PNSY drill program was divided between the shipyard Safety Officer and a CNRMA representative. The Safety Officer was responsible for drills required by the Industrial Ship Safety Manual for Submarines, and the CNRMA representative was responsible for coordinating integrated site drills. Neither believed they had responsibility for major shipboard casualty drills. Visits to other shipyards indicate a similar lack of ownership of major fire drills.[209,210,211,212]

(3) Despite the limited scope of PNSY fire drills prior to the MIAMI fire, several recurring deficiencies from previous drills had been identified. Specifically, records indicated repeated problems with on-scene DC equipment, personnel access or egress, and use of the CASCON system.[213]

(4) The PNSY firehouse consists of 26 firefighters. The Fire Chief stated that although it is a near certainty that physical exhaustion during a major fire will require mutual aid from nearby assets, he had no standing pre-planned response to request assistance.[214,215]

(5) Other than face-to-face, ship's force personnel could not communicate with Federal firefighters. Federal firefighters employed wireless communications that were not integrated with ship's force, other shipyard organizations, or the mutual aid responders.[216,217,218]

(6) Other than face-to-face, ship's force personnel could not communicate with each other. General announcing circuits and sound powered phones were inoperable and the CASCON system was inaudible topside.[219,220,221]

(7) NAVSEA guidance prohibits submarine crews from employing smoke generators throughout the ship or video equipment in the ER.[222,223,224]

(8) Federal firefighters interviewed at several installations stated that they are prohibited from routinely touring submarine ERs.[225]

(9) NAVSEA firefighting doctrine largely assumes the seat of the fire is known and corresponds to the location of the initial alarm. In reality, experience with serious fires such as those aboard MIAMI, GEORGE WASHINGTON, and WHIDBEY ISLAND indicate that the source of a major fire may not be initially known or easily identified.[226,227,228]

(10) Once the fire was well-established, the MIAMI responders could only attack the seat of the fire using a crawling approach that required use of their hands in a manner that precluded carrying equipment. While this technique is a common civilian firefighting tactic and is enabled by the Federal firefighters' equipment, Navy training and equipment do not support this tactic.[229,230,231]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

(4) (b) (5) [redacted]

(5) (b) (5)

(6) (b) (5)

Recommendations:

(1) TYCOMs coordinate with NAVSEA and CNIC to align applicable directives to establish a requirement for incorporating various casualty scenarios, including worst case conflagration events necessitating Federal and mutual aid F&ES response, into periodic shipboard training programs.

(2) (b) (5)

(3) TYCOMs evaluate all reasonable means to improve realism in shipboard fire training.

(4) (b) (5)

(5) (b) (5)

(6) (b) (5)

3.2.2. Live fire training requires improvement. Live fire trainers are beneficial for improving situational awareness, reducing anxiety and breathing rate, enhancing the ability to cope with elevated temperatures and reduced visibility, and building confidence with personal protective and firefighting equipment. However, the quality and frequency of Fleet and Federal live fire training varies widely, as does life cycle management of the devices.[232,233,234,235,236,237]

Findings of Fact:

(1) As a result of the major fire aboard USS BONEFISH in 1988, the submarine force procured six live fire trainers. Completed in the early 1990s, these devices have not been significantly updated since installation and there is no live fire trainer in Guam or Portsmouth, New Hampshire.[238]

(2) Naval Air Warfare Center – Training Systems Division (NAWC-TSD) conducts life-cycle management for six submarine live fire trainers and eleven surface community live fire trainers. NAWC-TSD receives roughly one million dollars per year from the surface warfare resource sponsor to upgrade the surface devices. The submarine warfare resource sponsor provides no similar funds for the submarine devices. NAWC-TSD provided the submarine training community proposals to upgrade their devices periodically since 2006, but no action has been taken on their recommendations due to lack of funds.[239]

(3) Submarine live fire devices were designed with a 15-year service life. The newest is 16 years old. Prior to the MIAMI fire, there were no funded service life extension programs or replacement plans for the submarine live fire trainers.[240]

(4) Other than thermal imaging cameras at five submarine sites, there is no way to record live fire training events for subsequent replay and critique in any surface, submarine, or Navy region device. The thermal imaging cameras, which cost approximately ten thousand dollars each, have demonstrated vulnerability to water damage and have been temporarily removed from service.[241,242]

(5) Both surface and submarine live fire trainer staffs require formal qualifications to operate their devices and teach their course. Surface instructors are subject to periodic practical assessment, although some of these reviews are not conducted using objective standards and tend to focus on instruction techniques. Submarine instructors are subject to periodic written examinations and assessments similar to surface trainer staffs.[243,244]

(6) None of the live fire trainer instructors interviewed participated in any professional development information sharing or training events with civilian firefighters, and consider NSTM 555 sufficient and comprehensive.[245,246]

(7) Both surface and submarine live fire trainer staffs reported that formal course reviews are typically not triggered by lessons learned from major Fleet fires. Rather, curricula updates usually occur on a fixed periodic basis. Other updates may be initiated by instructors.[247,248]

(8) Both surface and submarine live fire trainers operate at temperatures well below that of a major fire. As a result, issues such as scalding from wetted PPE and temperature stratification are not simulated.[249,250]

(9) Surface, submarine, and Navy region live fire trainer instructors evaluate students while wearing a complete set of PPE and enter with the students into the device. Noise, reduced visibility, and low light levels inhibit instructor ability to evaluate student performance.[251,252,253]

(10) Surface, submarine, and regional live fire instructors are not consistent in using objective standards for trainee evaluations. Additionally, although surface and submarine live fire courses have numerous knowledge-based topic learning objectives, no live fire course requires a written examination.[254,255]

(11) All surface and submarine live fire course training scenarios assume adequate firefighting capacity is available. As a result, evolutions such as SCBA bottle re-charging and multiple entries are not taught or evaluated.[256,257]

(12) None of the submarine courses and only the advanced surface course provide training scenarios with uncertainty as to the location of the seat of the fire.[258,259]

(13) Some scenarios within the submarine live fire courses elicit rapid response and are initiated without students wearing PPE. Rapid response scenarios are not included in the surface courses. Therefore, students enter surface live fire trainers fully outfitted in PPE. NFPA standards require students in a live fire device to wear PPE.[260,261]

(14) PNSY Federal firefighters did not conduct live fire training between 2006 and the MIAMI fire, although an annual live fire training requirement had been documented as complete for 2011 in ESAMS. According to the Fire Chief, the cessation of live fire training corresponded to the regionalization of the fire house. After the MIAMI fire, PNSY Federal firefighters conducted live fire training, although this was not formally evaluated.[262,263,264,265]

(15) Firefighting breathing technique training is available that may improve the duration of fixed capacity air system employment for fire responders.[266]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]
(b) (5)

(3) (b) (5)
(b) (5)

(4) (b) (5)
(b) (5)

(5) (b) (5)
(b) (5)

(6) (b) (5)
(b) (5)

(7) (b) (5)

Recommendations:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

(3) (b) (5)
(b) (5)

- Effects of heat stratification
- Impact of heat and water on PPE performance
- High temperature approach tactics
- Fire location identification tactics
- SCBA bottle re-charging
- Re-entry considerations, including fatigue and firefighting rehabilitation

- (b) (5)
- (b) (5)
- (b) (5)

(4) (b) (5)

(5) (b) (5)

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[162] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
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[236] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
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[246] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[247] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[248] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[249] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[250] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[251] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[252] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[253] Memorandum for the Record: NAWCTASD Visit, 15 August 2012
[254] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012

[255] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[256] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[257] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[258] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[259] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[260] Memorandum for the Record: SWOs Firefighting Trainer Joint Base Pearl Harbor-Hickam Visit, 3 August 2012
[261] Memorandum for the Record: NSTPC Firefighting Trainer Visit, 1 August 2012
[262] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[263] Memorandum for the Record: PNSY Firehouse Visit, 20 July 2012
[264] Summary of Interview (b) (6), 18 July 2012
[265] ESAMS Required Training Matrix for Structureborne Firefighter
[266] Memorandum for the Record: (b) (6) Interview, 6 August 2012

3.3. Technology Factors

The Panel examined a number of potential technological solutions to improve the response to major fires. The first three points in this section target technological improvements focused on shipboard C2 during major casualties, namely accessibility and temporary systems, automated monitoring and suppression systems, and communications. The remaining points focus on other vulnerabilities where technology offers a solution. The spectrum of operating conditions for naval vessels was considered; normal at sea operations (all systems operational, with a fully manned, alert crew), typical in-port situations (most ship systems intact, fewer personnel available), and the conditions a ship would experience during a major industrial availability (few or no ship systems intact, little or no internal control of ventilation, ship minimally manned). As discussed in section 3.1.2.2., during major availabilities, work practices are generally designed and optimized for maintenance and repair efficiency, and not for casualty prevention and response. This production optimization results in a series of conditions where hull and equipment configurations have been altered, and permanently installed shipboard systems are in a reduced status or non-operational. In most cases, temporary casualty response systems and equipment are made available for use, but are somewhat rudimentary. They have not been fully analyzed for adequacy in combating complex and sustained casualties in the same way that installed systems are scrutinized for ship survivability in the at-sea case. Under all operational environments, DC and PPE must be adequate to maximize the effectiveness of crew response, while providing satisfactory personnel protection. Additionally, for the industrial environment, cleanliness standards, processes, and equipment must be tailored for the environment. Finally, for the adaptation of new construction materials such as aluminum alloys and composites, technical evaluation is required to ensure that appropriate modifications are made to existing DC equipment and doctrine to ensure survivability under casualty conditions.

3.3.1. Hull and compartment accessibility and temporary system status are critical to DC efforts. The MIAMI fire reinforced the need for accurately tracking temporary hull openings and modifications to compartment isolations, while understanding their impact on ship-wide casualty response. These are not new lessons learned.

3.3.1.1. The placement and number of hull cuts can contribute to the severity of a fire. Hull openings from hatches, torpedo tube outer doors, and temporary hull cuts provided a continuous source of air introduction to the MIAMI fire which compounded the effort required to extinguish it. These hull openings had no in-place temporary closure capability which challenged DC teams while fighting the casualty.

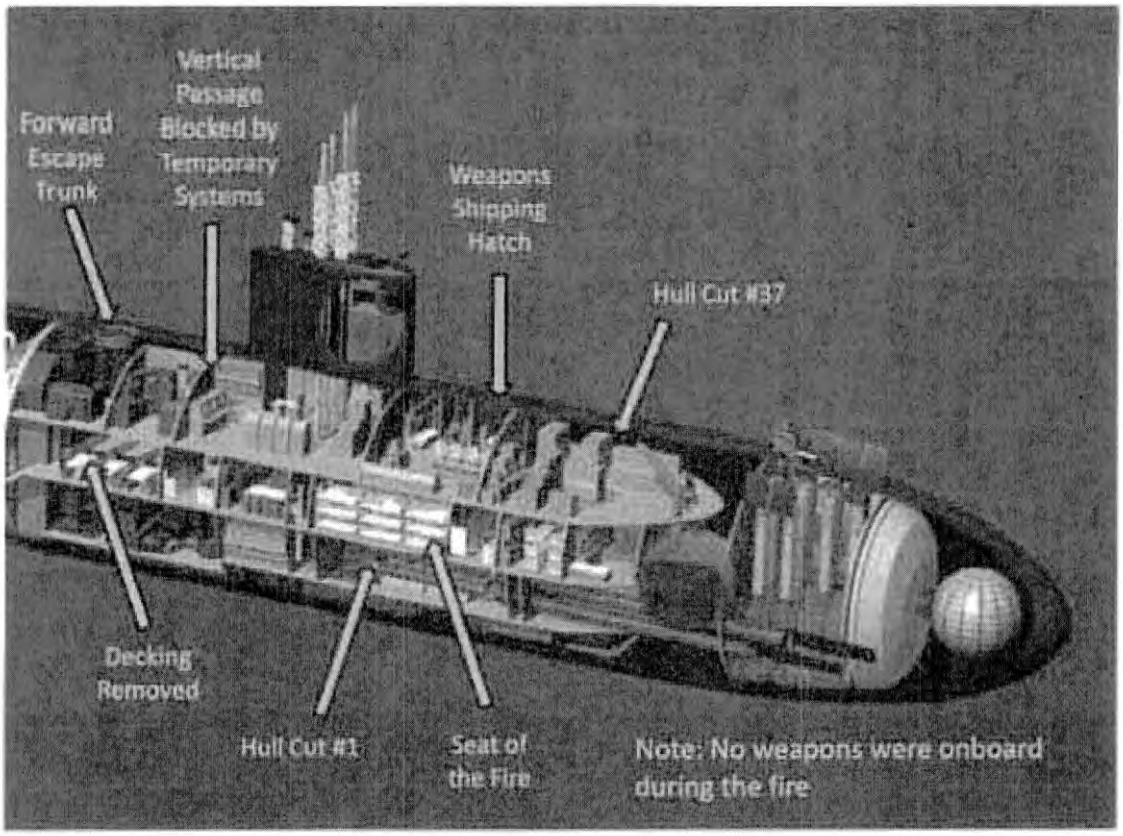


Figure 5: Location of Hull Cuts and Hatches

Findings of Fact:

(1) MIAMI was configured with two hull cuts in the FC to facilitate overhaul production work. During the casualty, ad hoc solutions were implemented to allow temporary closure or access of these hull cuts for the application of water to the fire, compartmentalization and containment of the fire, and de-smoking.[267]

(2) The side passageway door that separates the FC from the ER on MIAMI had been removed for maintenance. During the casualty, a rigid barrier had to be manufactured and installed to effectively isolate smoke and heat from the ER.[268,269]

(3) Throughout the casualty the outer torpedo tube doors remained open, allowing air flow into the ship below the waterline, providing an unintended 'potbelly stove' effect in the FC.[270,271]

(4) Federal firefighters typically have detailed diagrams of major buildings on their installations, However, the PNSY Federal fire department did not have a comparable schematic for shipboard application.[272,273]

Opinions:

(1) (b) (5) [redacted].

(2) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.3.1.2. Temporary systems are not well integrated, centrally controlled, or sufficiently resilient under casualty conditions. Temporary services are a necessary element in any availability where ship systems are removed from service or to support production work. While Fleet maintenance and CNO availability procedures discuss control of temporary systems from a work control standpoint, these procedures do not adequately address personnel and DC access considerations or resiliency during casualties.[274,275]

Fire hose and temporary services hinder access at FCML Ladder

Damage control equipment and temporary services in Command Passageway

Findings of Fact:

(1) Fire responders were unable to advance to the fire scene due to temporary services that had fallen from the overhead and blockage from in-place temporary services.[276]

(2) Temporary service strapping retainers were made of plastic and melted during the course of the fire, resulting in many temporary systems impeding access throughout the FC.[277]

(3) Temporary services did not have quick disconnects at common access points for compartment isolation or to facilitate access. On one occasion, a MIAMI crew member had to use a portable electric saw to destructively cut through a bundle of temporary service lines to enable firefighting.[278]

(4) Due to a lack of centralized documentation and control for temporary services, several hours were expended during the MIAMI fire to isolate, deenergize, or otherwise remove temporary services.[279]

(5) During the MIAMI fire, the temporary Emergency Air Breathing (EAB) system failed due to heat effects. This system was not designed to have independent operation between the FC and the ER and resulted in Maneuvering Area watchstanders losing their breathing air as smoke began to intrude into the ER.[280,281]

(6) There were three temporary EAB manifolds in each compartment onboard MIAMI.[282]

Opinions:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

(4) (b) (5)
(b) (5)

Recommendations:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

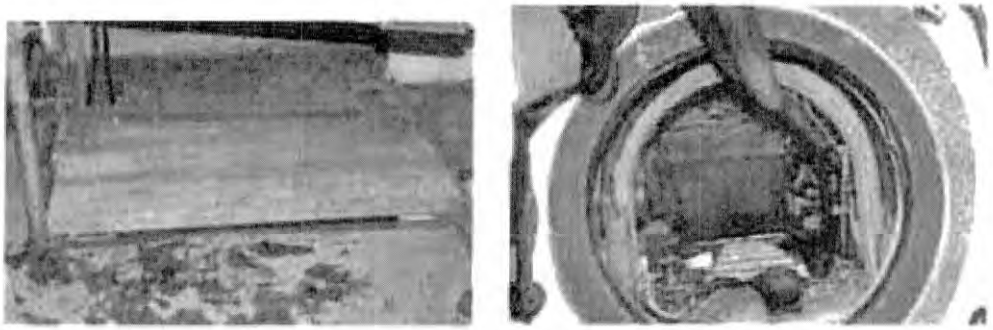
(4) (b) (5)

3.3.1.3. Temporary decking, hatch covers, and ladders made of wood are not adequate for casualty applications. Similar to other hull modifications, temporary decking, hatch covers, and ladders must withstand normal and casualty situations, while accommodating the necessary flexibility in design for maintenance efficiency. In the MIAMI fire, temporary decking was constructed from individual planks of fire-retardant lumber, which were not permanently affixed. This posed two problems: First, the lumber was easily removed, which resulted in the most significant personnel injury when a responder fell through the deck. Second, although the lumber was fire-retardant, it was still a combustible material that could have added to the overall fire loading under the extreme heat, further impeding access during the fire.

Findings of Fact:

(1) Ship's force fire responders removed wood planks used as temporary decking to access the AMR. This temporary decking was not replaced and later resulted in the injury of another ship's force responder.[283]

(2) Ship's force eventually replaced the wooden boards covering the Auxiliary Machinery Room (AMR) scuttle to ensure that the FET could be used as a safe access point.[284]



MIAMI Auxiliary Machinery Room scuttle temporary wood decking

Opinion:

(1) (b) (5)
(b) (5)

Recommendation:

(1) (b) (5)
(b) (5)

3.3.2. Major availabilities are conducted with a reduced margin of safety. Margin of safety is reduced in a major availability (and to a lesser extent pier side) due to the degraded status of shipboard systems and reduced manning. In the marine environment, ships are designed and constructed for DC at sea under combat conditions. Under these circumstances, the ships are at their highest state of operational and material readiness, and their crews are trained and certified for maintaining rapid response capability with the full complement of ship's systems. Precise and rapid response at sea is an essential element in containing casualties to keep them from developing into debilitating incidents. This strategy assumes that the crew is an integral component to the identification, warning, and response system during the earliest stages of the casualty. When the ship transitions into port, the reduced state of crew manning removes some of this response capacity due to fewer personnel on board, reduced supervision, and fewer watches being continuously manned. In the industrial environment, the gap is widened further due to the modified and degraded material status of many shipboard systems and the fact that crews are relocated off the ship in dry dock, leaving only a few roving watchstanders in their place. As an important consideration, the risk of fire and flooding on board ships in availability is arguably higher than at any other time.

3.3.2.1 Remote detection systems could have assisted in early detection and localization of the MIAMI fire, but were not installed. Remote detection systems for heat, smoke, and flooding can enable rapid identification and localization of a developing casualty in its earliest stages, partially mitigating the reduced crew presence and reduced DC system capability. While both heat and smoke sensing technologies have their limitations, their

adaptation can be designed into the shipboard environment. Smoke detectors are inexpensive and can assist in early detection of smoke in unmanned spaces. Their use would have to be considered in situations where hot work and grinding routinely produce light smoke and particulate airborne debris. Most heat sensors are bi-stable in nature and would likely be destroyed in a fire.

Heat Sensors		Thermocouples	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
• Inexpensive • Easy Install	• Limited Information • Power Source Required • Failure at high temperatures	• Continuous Temperature Data-aids in locating seat of fire • Power source not required • High temperature tolerance	• Cost • Complexity

Table 2: Heat Sensor and Thermocouple Comparison

The use of thermocouples could alleviate this concern and allow for monitoring a continuous temperature profile throughout a fire, which would potentially aid in locating an unknown fire seat. Heat detectors will only indicate when a pre-determined temperature threshold has been reached, and may not be able to be reset in a large fire when the entire compartment becomes very hot. Thermocouples have a second distinct advantage – they do not require a separate power source. Both technologies could potentially be implemented wirelessly, but wired components would likely have greater survivability in a major casualty.

Findings of Fact:

(1) Most ships in industrial availabilities do not have remote smoke or heat sensing systems installed to enhance their margin to safety under situations where reduced manning and degraded systems limit shipboard casualty response assumptions.[285]

(2) While smoke detectors cannot definitively localize the source of a fire, these detectors do provide early detection of an abnormal condition for follow-up investigation and response.[286]

(3) Thermocouple heat sensors are generally robust and can provide early detection of excessive temperature thresholds, as well as continuous temperature profiles throughout a casualty.[287]

(4) Wired systems are typically robust and more likely to withstand casualty conditions compared to their wireless counterparts.[288]

Opinion:

(1) (b) (5) [redacted]

Recommendation:

(1) (b) (5) [redacted]

3.3.2.2. Many classes of ships do not use large-scale active fire suppression systems. Fire suppression systems, such as Halon or sprinkler systems, may assist in automating fire response for situations where manning limitations or equipment configurations have been modified to a reduced state of readiness. Although the response of these systems may be somewhat indiscriminate in nature, leading to undesirable effects under certain circumstances, their employment may be preferential for some in port and industrial availability applications. For example, under non-casualty conditions a malfunctioning fire sprinkler system near energized electrical components could cause more damage than it was designed to prevent. Careful evaluation to each operating environment would have to be considered for implementation of these types of systems.

Finding of Fact:

(1) Ships in industrial availabilities do not have remote fire suppression systems of sufficient scale installed in situations where reduced manning and degraded systems limit shipboard casualty response.[289]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Fire Suppression Grenade

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.3.2.3 Lack of integrated communications significantly hampered casualty response. Effective casualty response efforts are enhanced with accurate and timely information flow. During industrial availabilities, shipboard communications systems are routinely disabled in support of maintenance. Under these circumstances temporary casualty announcing and alarm circuits are installed to supplement ship's systems, but they are inadequate substitutes in a casualty situation. In the MIAMI fire, as in other prior Fleet mishaps,[291,292,293] inadequate communications and communication systems hindered casualty response efforts, incurring a much greater risk to personnel safety while increasing ship damage. Specifically:

- Ship's force was unable to understand CASCON announcements
- Federal and mutual aid firefighters were unable to communicate with ship's force due to a lack of compatible radios
- There was no method to track the identity or well being of ship's force firefighters below decks
- The command element was limited to face-to-face communications and reporting on the ship's brow[294]

Findings of Fact:

(1) Normal shipboard communication and alarm systems had been disabled to support production work and had been replaced with CASCON on MIAMI. The CASCON was not tied directly to the shipyard fire department, and required watchstanders to relay the information from the CASCON.[295,296]

(2) When the CASCON alarm was activated onboard MIAMI, fire response was directed to the location where the alarm was initiated, not the location of the fire.[297,298,299,300]

(3) Ship's force teams did not have communications circuits available for use between below decks and topside throughout the duration of the MIAMI fire.[301,302,303]

(4) Ship's force, Federal firefighters, and mutual aid firefighters did not have a common communications circuit during the casualty, and relied upon a combination of firefighter radios and direct face-to-face reports topside throughout the casualty. The CO was unable to receive real time reporting of conditions below decks while he was attempting to direct casualty efforts topside.[304,305]

(5) Commercial systems exist in a readily adaptable configuration to support visualization and integrated monitoring of access points, personnel, communications, and equipment status.[306]

Opinions:

(1) (b) (5)

(2) (b) (5)

(3) (b) (5)

(4) (b) (5)
(b) (5)

Recommendation:

(1) (b) (5)
:

- (b) (5)
- (b) (5)
- (b) (5)

3.3.2.4. Temporary fire main and hose reels replace permanently installed systems in the industrial availability environment, yet these systems have reduced capacity, poor proximity to below decks areas, and require multiple watchstanders for employment. Temporary systems require modifications to shipboard fire response procedures and training to account for differences from permanently installed systems. Such accommodations are common in the case of submarine availabilities due to the cross functionality of the trim system as the

ship's fire main. Temporary fire systems are inferior in design and application since their placement is topside, requiring fire responders to route hoses originating from topside connections to areas below decks. This configuration requires more personnel to respond to a fire while routing fewer hoses a longer distance.

Findings of Fact:

(1) Temporary firefighting systems frequently replace shipboard systems during industrial availabilities, and are not required to have the same capacity, proximity to below decks areas, or design ruggedness as normally installed ship's equipment.[307] For example, temporary fire nozzles provided for MIAMI were made of plastic. The crew replaced these nozzles prior to the fire with standard shipboard brass nozzles.[308]

(2) VIRGINIA and SEAWOLF class submarines are configured with a hose reel system as part of their installed equipment that allows one crewmember to employ a fire hose for rapid response.[309,310]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.3.2.5. To ensure continuous application of extinguishing agent occurs during a fire a rapidly deployable, intermediate capacity delivery system is required. Navy firefighting procedures employ portable fire extinguishers and large diameter fire hoses. As demonstrated onboard MIAMI and a subsequent large-scale fire drill at PSNS, responders struggle to continuously apply extinguishing agent using this equipment.

Findings of Fact:

(1) MIAMI responders did not continuously apply extinguishing agent to the fire.[311]

(2) Responders to the post-MIAMI major fire drill at PSNS did not continuously apply extinguishing agent to the fire.[312]

(3) SEAWOLF and VIRGINIA class submarines are equipped with single-person, non-collapsible hoses designed for rapid employment.[313,314]

Opinion:

(1) (b) (5)

Recommendation:

(1) (b) (5)

3.3.3. Inadequate firefighting and PPE hindered crew response during the MIAMI fire. Tailor DC equipment (including both response gear and personnel protective equipment) to meet the demands of the shipboard environment. Some of the DC deficiencies cited in this report were identified in previous Fleet mishaps but were never improved. In the MIAMI case, the firefighting response was not optimized due to poorly performing firefighting and personnel protective equipment, including the SCBA, the firefighting ensemble (FFE), and battle lanterns. In most cases, superior alternatives exist for this equipment and had not been adopted for fleet use.

3.3.3.1. Thermal imager performance suffers in high ambient temperature environments and fails to locate the seat of the fire. Thermal imagers exploit temperature differentials between ambient conditions and discrete heat sources, providing a heat source 'image' used for locating the seat of a fire and identifying immobilized personnel in a smoke filled compartment. Thermal imagers have been employed by the Navy for several decades, and have been upgraded since their introduction.[315] The current thermal imager in use is the Talisman which was widely deployed to the Fleet as a corrective action to the USS GEORGE WASHINGTON fire. This device employs mid-1990's technology and suffers from 'red out' conditions in high ambient temperature environments. In these cases, the detector becomes saturated and no longer discerns heat profile gradients. When this condition occurs, the thermal

imager becomes useless, leaving fire responders without a critical tool for combating the fire. As recently as 2007, two separate shipboard fire mishap reports identified thermal imager saturation in high ambient temperatures as a noted deficiency, significantly limiting the effectiveness of fire response efforts.[316,317] In the MIAMI fire incident, thermal imager saturation contributed to fire responders failing to locate the source of the fire for over 160 minutes.[318,319]

Findings of Fact:

(1) Thermal imager saturation in high ambient temperature environments is a documented issue spanning several mishaps.[320,321]

(2) During the MIAMI fire, thermal imager saturation rendered the device useless for locating the seat of the fire and for searching for injured or incapacitated personnel in a smoke filled compartment.[322,323,324,325]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Recommendation:

(1) (b) (5) [redacted]

3.3.3.2. SCBA longevity is inadequate for sustained firefighting efforts, and must incorporate on-scene recharging capability. SCBA performance assumptions follow shipboard firefighting doctrine that fires are identified rapidly, attacked aggressively, and extinguished before they are allowed to grow into large sustained events. The problem lies in events that go beyond the rapid response phase, where sustained firefighting efforts are required to save lives or save the ship. For ships pier side or in an industrial availability, reduced crew presence and increased response times all point to the need for larger capacity SCBAs. These longevity issues are not a new concern based on previous Fleet mishap lessons learned. A 1994 mishap report recommendation from Commander, Sixth Fleet identified that the refill capability and limitations for the SCBA made the system insufficient to sustain firefighting efforts for more than 30 minutes.[326] This advertised duration does not match practical application. On board MIAMI, responders were limited to only 15 minutes, creating a situation where responders were unable to attack the fire after transiting for 10 minutes to the scene. This reduced capacity significantly contributed to several extended periods of time during which no extinguishing agent was being applied. In addition to bottle capacity, recharging capability is essential for SCBA employment. On board MIAMI, SCBA recharge capability, normally available in both compartments on the ship, was disabled for maintenance. Lack of on-scene recharge capability further hampered

effective response efforts, resulting in fire teams borrowing gear from an adjacent unit to supplement the SCBA load out while transporting expended bottles to the fire station for recharging.[327,328,329]

Findings of Fact:

(1) SCBA longevity on board MIAMI was a major limitation in fire response efforts and contributed to excessive periods of time without the application of extinguishing agent.[330,331,332]

(2) SCBA longevity has been a previous Fleet concern.[333]

(3) SCBA bottles are manufactured with 30, 45, and 60 minute capacity. Most Navy ships are equipped with a combination of 30 and 45 minute bottles, according to a standard allowance parts listing. Until the MIAMI fire, most submarines contained 30 minute bottles.[334,335,336] The 45 minute bottles are approximately five pounds heavier and one inch larger in diameter than the 30 minute bottle. Prior to the MIAMI fire, NAVSEA SHIPALT 4668D was issued to replace all 688 class submarine SCBAs with 45 minute bottles.[337] Implementation has just begun on submarines. Additional SHIPALTS are being pursued to outfit other submarine classes similarly. Typical surface ship loadouts by class are shown below.

(4) Shipboard SCBA recharge capability is often disabled in availabilities when high pressure air system maintenance is required, leaving ships without organic recharging capability.[338] Subsequent to the MIAMI fire, NAVSEA and CNIC directed each naval shipyard and installation to obtain portable SCBA recharging capability.[339]

Ship Class	SCBA Apparatus	30 Minute Cylinders	45 Minute Cylinders
CG	55	98	98
CVN	382	746	364
DDG 51 – 78	73	98	98
DDG 79 and follow	73	98	154
FFG	55	98	98
LHD	278	278	278
LSD	95	183	183
LPD	191	277	296
LCC	110	183	183
LCS	38	60	78
MCM	10	0	96
PC	25	0	10

Table 3: Surface Ship SCBA Loadout by Class

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Recommendations:

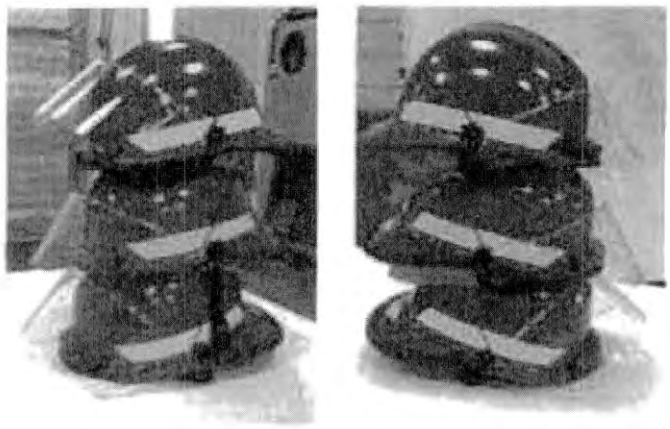
(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.3.3.3. The FFE is inadequate to prevent steam burns near the head, face, and hands, and is not designed for high ambient temperatures. Although the FFE provides some personal protection in high temperature environments, its vulnerabilities were highlighted during both the MIAMI and GEORGE WASHINGTON fires. Some disparity exists between surface ship and submarine FFEs, primarily due to stowage and space considerations. For example, submarine FFEs do not include helmets or boots, instead utilizing fire retardant cloth fire hoods and personal foot wear. Submarine equipage limitations should be carefully reconsidered in the industrial environment, where the likelihood of fire is greater and off-hull DC equipment stowage lockers are available. Modern fire helmets with stackable storage configuration are sufficiently compact for the underway submarine environment.[340,341] In the MIAMI fire, several instances of personal injury occurred due to scalding of the head and neck from fire hood wetting and subsequent steam formation. In the absence of firefighting helmets, there was little to protect the fire responders in the high temperature environment. Fire gloves were also inadequate against steam burning, becoming soaked from firefighting water and then subject to steam flashing.[342,343] Firefighting suits offer some protection, but are not designed for sustainment in excessive heat environments, limiting their effectiveness.[344]

Limitations of PPE

"Only moments after entering the space to battle the blaze (on board training/test ship ex-USS Shadwell), the fire team was forced to retreat due to the heat. Sweat-soaked PPE exposed to the 754-degree temperatures within the space began to "boil" the men's skin. Once outside, safety observers quickly peeled away the steaming gear."



Stackable Firefighting Helmet with LED

Findings of Fact:

(1) Several instances of personal injury due to steam burns on the head, neck, face, and hands occurred during the MIAMI fire due to limited effectiveness of PPE.[345,346]

(2) Submarine FFEs do not employ helmets or firefighting boots primarily due to space limitations. FFEs are not augmented during industrial availabilities.[347,348]

(3) FFEs are not designed for sustainment in extreme temperature environments. They offer little protection in circumstances where extended proximity to a high temperature fire may be required, such as investigation to determine the seat of the fire, or to egress incapacitated personnel.[349]

Opinions:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

(3) (b) (5)
(b) (5)

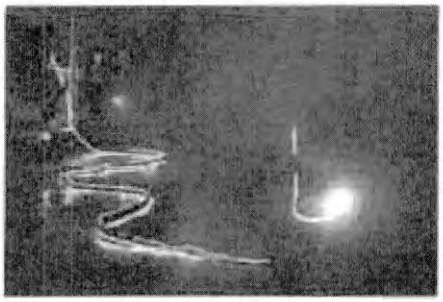
Recommendations:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

(3) (b) (5)
(b) (5)

3.3.3.4. Battle lanterns are bulky and heavy, cannot be fastened to FFEs, and provide no illumination capability in a smoke-filled compartment. Inadequate lighting was a prevalent problem in the MIAMI fire, where visibility in the FC was less than a few inches. Personnel movements, hose routing, and temporary service clearing were hampered by a lack of visibility. Traditional shipboard battle lanterns utilize dated battery and light bulb technology and provide inadequate illumination in the presence of smoke. An LED conversion alteration and improvement item (A&I N3504 for 688 class submarines, A&I N3529 for SEAWOLF class submarines) has recently been introduced to the Fleet. This modification improves illumination and reduces the weight of the battle lantern, but still utilizes the traditional bulky lantern case, which cannot be readily attached to the FFE.[350] Readily available commercial LED products offer light weight pocket mounted or head mounted options with wavelength optimization to penetrate smoke filled atmospheres. Luminescent materials for fire hoses and fire suits allow rapid sighting capability for fire responders under reduced visibility. The Panel reviewed two Fleet mishaps between 1997 and 2007 identifying commercial LEDs used by professional firefighters as superior to shipboard options.[351,352]



"Moonlight Hose" Utilizing Side-Light Fiber Optic Lighting System

LED Lighting (Military qualified solid state lighting fixture)

Findings of Fact:

(1) Shipboard battle lanterns are ineffective for illuminating smoke filled compartments.[353,354,355]

(2) Submarine battle lantern LED conversion A&Is are for disabled submarine (DISSUB) longevity considerations, not optimized for firefighting.[356]

(3) Commercial products offer lightweight, hands-free, and adaptable LED and illumination options, with wavelength optimization to penetrate smoke contaminated atmospheres.[357]

Opinions:

(1) (b) (5) (b) (5)

(2) (b) (5) (b) (5)

(3) (b) (5) (b) (5)

Recommendations:

(1) (b) (5) (b) (5)

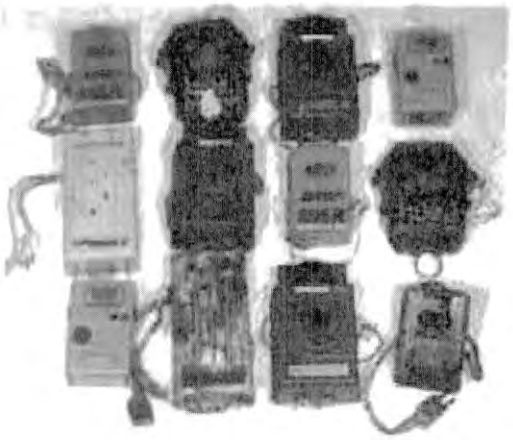
(2) (b) (5) (b) (5)

3.3.3.5. Fleet firefighters are not equipped with Personal Alert Safety System (PASS) devices. All civilian and Federal firefighters are equipped with PASS devices which provide an audible alarm should a firefighter become immobilized for a preset period of time. Given the density of smoke and low visibility seen during the MIAMI fire, incapacitated ship's force firefighters likely would not have been located prior to expending their SCBA air.

Findings of Fact:

(1) Ship's force firefighters are not provided with PASS devices.[358]

(2) PASS are commercially available and provide an audible alarm and warning when fire responders become immobilized.[359,360]



PASS devices:
http://www.usfa.fema.gov/fireservice/research/safety/pass2.shtm

SUPERPASS:
http://www.amerigroupnetworks.com/passdevices.html

Various PASS Devices

Opinion:

(1) (b) (5)

Recommendation:

(1) (b) (5)
(b) (5)

3.3.3.6. Standard shipyard DC lockers do not contain an adequate compliment of equipment in close proximity to the ship. The MIAMI fire identified several unintended consequences of relocating DC equipment off the ship. By clustering the location of available equipment, point of entry is limited and must include hatch transit. Conversely, in the normal shipboard configuration, DC equipment is dispersed throughout the ship, enabling rapid access, casualty triage, and multiple points-of-approach and attack options. The MIAMI CO recognized

the lack of standardization for dry dock DC equipment pre-staging and requested that PNSY construct DC lockers for improved placement, storage, and access.[361]

Findings of Fact:

(1) No standardized DC locker configuration exists for ships in industrial availabilities.[362]

(2) DC equipment was not evaluated for appreciable differences between the at sea and industrial environment, including quantity and distribution.[363]

Opinions:

(1) (b) (5) (b) (5) .

(2) (b) (5)

(3) (b) (5)

Recommendation:

(1) (b) (5) (b) (5)

3.3.4. Industrial availability and in port casualty response planning inadequately accounts for high energy systems and hazardous material (HAZMAT). High energy systems (e.g., nuclear reactor, main storage battery, hydraulic power plants, etc.) and HAZMAT present a potentially significant complication to casualty response. In industrial availabilities, most of these systems are placed in a configuration that supports safe working conditions. However, the risks posed by some of these systems can never be completely removed. Three of the most significant shipboard fires in the last thirty years have been associated with submarine or submersible battery fires, and in two of those cases resulted in the loss of the ships.[364,365,366]

3.3.4.1. A submarine main storage battery presents a significant firefighting hazard. The MIAMI was fortunate that the ship's main storage battery was removed for a SHIPALT. If the ship's main storage battery had been installed, fire response could have created potentially explosive conditions in the battery compartment.

Findings of Fact:

(1) Main storage battery removal is not part of a standard submarine industrial availability work package, unless battery compartment unrestricted operation inspections or battery change out is required.[367]

(2) Main storage lead-acid battery fires may degenerate if water is introduced due to uncontrolled inter-cell currents, high heat generation, and the formation of hydrogen gas in explosive concentrations.[368]

(3) The PNSY Fire Chief did not understand the status of the ship's main storage battery, and did not consider its presence or absence as an element to his firefighting response.[369]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Recommendations:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

3.3.4.2. The risks posed by other high energy systems and HAZMAT during casualties are inadequately addressed. Similar to a submarine's main storage battery, other high energy systems and HAZMAT present unique firefighting challenges and could significantly compound a casualty. For example, during the Li-Ion battery fire on ASDS-1 in 2008, firefighting efforts were less efficient and responders were placed at greater risk because on-scene firefighting information was lacking. In this case, it took two hours for a crew member to drive to a Federal fire department site with electronic and printing access and physically return with HAZMAT information.[370]

Findings of Fact:

(1) There is limited doctrine addressing the complications imposed to casualty response by high energy systems or HAZMAT.[371] For example, there is no doctrine providing tactics and techniques to combat a submarine valve-regulated lead-acid battery fire or a major fire in the vicinity of a submarine main storage battery.

(2) Pre-fire incident response plans do not always consider fire susceptibility of high energy systems or HAZMAT.[372]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

Recommendations

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

(3) (b) (5) [redacted]

3.3.5. Cleaning practices and equipment stowage for industrial availabilities require standardization. There are no standardized requirements for cleaning practices, equipment, or staging areas for ships in an industrial availability. Understanding the importance of cleanliness, the MIAMI project responded like many other Fleet units have done and established their own clean-up policy, coordinating with their project team in conjunction with production work while maintaining a minimum self-defined standard. To support this effort, WRSR1 was used as a central staging area for cleaning equipment to include cleaning rags, oil absorbent material, solvents, and plastic wet/dry vacuum cleaners. Since the WRSR area is a low density work area during overhaul, the cleaning material staging point seemed logical. However, the MIAMI fire started in a bag of cleaning rags within WRSR1, where the combustible material loading compounded the growth and sustainment of the fire.

Findings of Fact:

(1) No requirement exists for managing cleanliness materials during industrial availabilities, including staging and storage requirements, and accessibility.[373]

(2) The combustible material loading in WRSR1 contributed to the extent of the casualty.[374]

(3) Plastic wet/dry vacuum cleaners are combustible when exposed to significant heat.[375]

Opinions:

(1) (b) (5) [redacted]

(2) (b) (5) [redacted]

Recommendation:

(1) (b) (5) [redacted]

3.3.6. Submarine hot work practices and industrial cleanup are adequate. Hot work and fire watch procedures on submarines are governed by the Standard Submarine Organization and Regulations Manual (SSORM). The SSORM requires the SDO to ensure that applicable requirements are met by all fire watches on the ship, including non-ship's force personnel, and has strict regulations in place to maximize fire prevention and facilitate a quick response if necessary.[376] There is no indication that hot work or fire watch procedures are inadequate or contributed in any way to the MIAMI fire.

3.3.7. Design and configuration variance for shipboard fire protection systems warrant additional investigation. Ship configurations incorporate design based on material, personnel manning, access, mission, and survivability considerations. These criteria are established at the PEO level, in conjunction with OPNAV and TYCOM stated requirements. Throughout the life of a specific platform program, variance may be introduced that includes material deviation and substitution and engineering design change based on in service performance and platform testing.[377] As with other design and manufacturing alternatives, fire protection systems are subject to technical review considering risk acceptance (a function of both likelihood and severity of consequence) as well as cost and resourcing limitations. Fire survivability factors are not equivalently developed for all environments in which a ship operates, including in port and in availability. During the Panel's investigation of these factors, a notable variance was identified for several platforms that may warrant additional investigation to ensure that appropriate fire survivability requirements have been adopted.

CVN 21 LFT&E Hangar Bay Fire Test (0.16 gpm/ft²)

Findings of Fact:

(1) The majority of 688 class and all OHIO class submarines were manufactured with MIL-P-15280 combustible hull insulation in the ER.[378]

(2) CVN fire insulation requirements have not been uniform across all classes of carriers, with CVN 78 being the only carrier to have fire insulation installed.[379]

(3) The adaptation of smoke detection systems on CVNs has not been uniform across all classes of carriers.[380]

(4) Fire survivability assumptions for all classes of Naval ships are invalidated under certain in port and in availability conditions when shipboard systems are disabled and crew manning is significantly reduced.[381]

Opinions:

(1) (b) (5)
(b) (5)

(2) (b) (5)
(b) (5)

Recommendations:

(1) (b) (5)
(b) (5)

(2) (b) (5) [redacted]

[267] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[268] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[269] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[270] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[271] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[272] Summary of Interview of (b) (6) [redacted] 18 July 2012
[273] Summary of Interview of (b) (6) [redacted] 18 July 2012
[274] COMUSFLTFORCOMINST 4790.3 Rev. B CH 5, Joint Fleet Maintenance Manual (JFMM)
[275] Industrial Ship Safety Manual for Submarines, S9002-AK-CCM-010/6010
[276] Summary of Interview of (b) (6) [redacted] 1 August 2012
[277] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[278] Summary of Interview of (b) (6) [redacted] 1 August 2012
[279] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[280] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[281] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 29 August 2012
[282] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 29 August 2012
[283] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[284] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[285] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[286] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[287] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[288] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[289] Memorandum for the Record: (b) (6) [redacted] Interview, 6 August 2012
[290] Pyrogen Grenade product brochure (pyrogen_grenade.pdf)
[291] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[292] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[293] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[294] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[295] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[296] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 29 August 2012
[297] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[298] Summary of Interview of (b) (6) [redacted] 18 July 2012
[299] Summary of Interview of (b) (6) [redacted], 18 July 2012
[300] Summary of Interview (b) (6) [redacted] 1 August 2012
[301] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[302] Summary of Interview of (b) (6) [redacted], 18 July 2012
[303] Summary of Interview of (b) (6) [redacted], 1 August 2012
[304] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[305] Summary of Interview of (b) (6) [redacted], 18 July 2012
[306] Casualty Information Display, DC Notepad, and Ventilation Control Application in the "Submarine Ventilation Control Application and DC Application Notepad Test – Phase II, Large Scale Fleet Fire Test Evaluation report dated 5 Dec 2000
[307] Email with attached PPT from (b) (6) [redacted], 12 September 2012

[308] Summary of Interview of (b) (6), 1 August 2012
[309] VIRGINIA class submarine Ship Systems Manual
[310] SEAWOLF class submarine Ship Systems Manual
[311] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[312] Memorandum for the Record: Puget Sound Naval Shipyard Fire Drill 22 August 2012
[313] VIRGINIA class submarine Ship Systems Manual
[314] SEAWOLF class submarine Ship Systems Manual
[315] Naval Engineering Center NFTI Training Brief
[316] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[317] Fire in Combat Systems Electronics Space COMSUBRON 7 Lessons Learned, 18 April 1997
[318] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[319] Summary of Interview (b) (6), 1 August 2012
[320] Naval Engineering Center NFTI Training Brief
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[322] Summary of Interview (b) (6), 1 August 2012
[323] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[324] Email with PPT from (b) (6), 12 September 2012
[325] Naval Engineering Center NFTI Training Brief
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[327] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[328] Summary of Interview of (b) (6), 18 July 2012
[329] Summary of Interview (b) (6), 1 August 2012
[330] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[331] Summary of Interview of (b) (6), 18 July 2012
[332] Summary of Interview of (b) (6), 1 August 2012
[333] Self Contained Breathing Apparatus Refill Capability COMSIXTHFLT Lessons Learned, 1 August 1994
[334] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[335] Memorandum for the Record: Afloat Training Group (ATG), Norfolk Site Visit, 27 August 2012
[336] Email from (b) (6) 7 September 2012
[337] NAVSEA SHIPALT SSN688 4668D
[338] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[339] NAVSEA msg SER 001 dtd 261400ZJUL12
[340] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[341] Bullard TRAKLITE Fire Helmet PDF
[342] Summary of Interview of (b) (6), 18 July 2012
[343] Summary of Interview of (b) (6), 1 August 2012
[344] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[345] Summary of Interview of (b) (6), 18 July 2012
[346] Summary of Interview (b) (6), 1 August 2012
[347] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[348] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[349] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[350] Battle Lantern / LED A&I
[351] Fire in Combat Systems Electronics Space COMSUBRON 7 Lessons Learned, 18 April 1997
[352] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[353] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[354] Summary of Interview of (b) (6), 18 July 2012
[355] Summary of Interview (b) (6), 1 August 2012
[356] NAVSEA A&I N3504 for 688 class submarines

[357] " Preliminary Review of Potential Technology Enhancements in the Area of Fire Prevention, Detection, Mitigation and Firefighting within Industrial Environments" (NAVSEA Preliminary Technology Review.pdf)
[358] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[359] Memorandum for the Record: (b) (6) Interview, 6 August 2012
[360] "How to Choose a PASS System - FIRE CHIEF article | Tracking and Accountability", 1 July 2010, http://firechief.com/tracking-and-accountability/mixed-bag
[361] Summary of Interview of (b) (6) 1 August 2012
[362] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[363] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[364] Command Investigation to Inquire into the Circumstances Surrounding the Fire on USS BONEFISH (SS 582) Which Occurred on 24 April 1988
[365] Investigation to Inquire into the Circumstances Connected with a Battery Casualty which Occurred on board USS GUITARRO (SSN 665) on 17 May 1984
[366] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[367] Memorandum for the Record: MIAMI Fire Panel Tour of PNSY, 18-19 July 2012
[368] Naval Ships' Technical Manual Chapter 555 – Volume 2: Submarine Firefighting
[369] Memorandum for the Record: PNSY Firehouse Visit, 20 July 2012
[370] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[371] Memorandum for the Record: Doctrine Review, 24 September 2012
[372] Memorandum for the Record: PNSY Firehouse Visit, 20 July 2012
[373] MIAMI Fire Improvements Brief to the 3 Star Oversight Board 1 August 2012
[374] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[375] Command Investigation into the Fire that Occurred On board USS MIAMI (SSN 755) on 23-24 May 2012
[376] Standard Submarine Organizational and Regulations Manual (SSN), COMSUBFORINST 5400.39A
[377] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012
[378] MIAMI Fire Improvements Brief to the 3 Star Oversight Board, 31 August 12
[379] John Farley, NRL Fire Test Engineer Interview, 3 August 2012
[380] John Farley, NRL Fire Test Engineer Interview, 3 August 2012
[381] Memorandum for the Record: NAVSEA 05 Visit, 24 August 2012

4. ASSESSMENT OF ACTIONS TO DATE

4.1. Summary

Following the fire on board MIAMI, a Flag Officer oversight charter was established between Commander NAVSEA, CNIC, and COMSUBFOR for the purpose of resolving issues that crossed organizational lines relevant to combating a major shipboard fire in an industrial environment. This Flag Oversight Board initially directed the establishment of four working groups to capture lessons learned from the incident, and to develop and ensure completion of the associated corrective actions. The four working groups were defined as the Emergency Planning and Fire Drill working group, the Industrial Process working group, the Firefighting Process working group, and the Technology Improvements working group.[382]

Each working group was structured with a Flag Officer lead, accompanied by a subordinate Team Leader within the three parent organizations. Team member assignments incorporate stakeholder representation from applicable Navy-wide commands, intended to ensure proper staffing, support, and organizational interface. The Flag Oversight Board directed each working group to structure their action items according to a short term (accomplish within 30 days), medium term (accomplish between 30 and 90 days), and long term (accomplish beyond 90 days) schedule. Since the Flag Oversight Board charter was officially signed on 31 July 2012, working group action item timelines were generally accepted to start on this date.

During the month of August 2012, the working groups briefed the Flag Oversight Board on a bi-weekly basis. These briefs outlined the activities of the working groups. The Panel was invited to observe these briefings, and monitored the activities of each group.

The Panel has observed a common theme with the working groups. Short term, 'just do it now' actions (such as mandating SCBA recharge capability pier side and abolishing plastic vacuum cleaners on board ships in availability) languished within working group bureaucracy, until the personal involvement of Commander, NAVSEA was required to drive action. Similarly, as the short term actions were completed and the working groups transitioned to longer term initiatives, teams struggled to establish action items where process and accountability drove implementation and execution. Sensing diminishing returns from the working groups, a "strategic pause" was directed following the 31 August 2012 Flag Oversight Board briefing to allow each working group to realign priorities and restructure their work going forward.

The Panel considered the strategic pause to be warranted. During the strategic pause, Commander NAVSEA directed the establishment of a fifth working group, a NAVSEA Headquarters Response Group, to address additional concerns. The Panel considered the formation of the Headquarters Response Group to be a positive sign. The Headquarters Response Group could potentially focus on many of the recommendations provided in section 3.1.3.2 and elsewhere in this report. The strategic pause was also utilized to reprioritize actions of the four working groups and to address necessary changes to higher level directives.

On 26 September 2012, the three-star Flag Oversight Board was again briefed. From the Panel's perspective, the restructured priorities are a significant improvement. However, the working groups continue to struggle. Significant issues continue to be driven at the three-star level, and there is no clear ownership for items that cross NAVSEA and CNIC organizational lines. The Panel considers that continued involvement from outside leadership will help drive those cross-functional issues to resolution.

A tabular summary of working group actions is included below. Many of the actions recommended by the Panel in section 3 of this report are in progress, and are annotated in Appendix D.

4.2. Emergency Planning Fire Drill Working Group Action Summary

Emergency Planning Fire Drill Working Group	
Item	**Comments**
NAVSEA 11320 Ser 04R/030 dtd 20 Jul 12.[383] Outlines major fire response use of ECC procedures.	Directs all NSYs to develop a fire response policy to combat a major fire on board a submarine undergoing shipyard availability. It also directed PSNS and IMF to prepare for the first major fire drill associated with this document. Action pending.
22 Aug, 2012, PSNS Fire Drill.	Drill lessons learned and follow on actions are being coordinated between this working group and the Headquarters Response working group. A revision to the NAVSEA 11320 Request for Action memo will be issued. Action pending.
PHNSY Fire Drill, est. 10/1/12.	The date of this drill is pending staffing and training on lessons learned from 22 Aug 12 PSNS drill. Action pending.
Complete drills at all naval shipyards then expand to include private shipyards.	Action pending.
Lessons learned and best practices incorporated into NAVSEA and CNIC existing doctrine as well as NSY Fire Safety and Response Plans.	Action pending.
Develop emergency response principles, similar to the nuclear reactor accident model.	'Bolt-on' principles incorporated at PSNS. Evaluation at other installations pending.

4.3. Industrial Process Working Group Action Summary

Industrial Process Working Group	
Item	**Comments**
NAVSEA message, Ser 001, DTG 261400ZJUL12.	Directed site specific coordinated response plan, pier side recharging of SCBA bottles, and radios. Directed ship's force and F&ES monthly training requirements. Two naval installations (SUBBASE Kings Bay and Naval Station, Mayport) reported non-compliance with firefighting requirements of NAVSEA message, Ser 001, DTG 261400ZJUL12.
NAVSEA message, Ser 002, DTG 221532ZAUG12.	Addressed requirements for routing and tracking temporary services, staging, and markings associated with quick disconnects.
NAVSEA message, Ser 003, DTG 241233ZAUG12.	Established requirement for metal canister vacuum cleaners for shipboard use.
Replacement of all 30 minute SCBA bottles on submarines with 45 minute SCBA bottles.	ShipAlt 4668D for 688 class submarines in progress. Other class ShipAlt's pending.
Investigate electronic temporary services lead tracking device.	Complete for VIRGINIA class. Evaluation for other applications pending.
Temporary EAB system isolable to each compartment.	Implemented at PNSY. Other site implementation pending.
Evaluate hull cut strategy.	Action pending.

4.4. Firefighting Process Working Group Action Summary

Firefighting Process Working Group	
Item	**Comments**
Headquarters Program Director Advisory (HPD) (2012-02) [384].	Directed standardization of equipment in use for CNIC F&ES.
HPD (2012-03) drafted and routing for approval.	Advisory will establish an annual live fire training requirement for shipboard firefighting. It will also direct the development of a standard "Pre-Incident Plan" for all ships. Action pending.
Updating OPNAVINST 11320.23G, Navy Fire & Emergency Services Program (Ashore).	To include updates from HPDs (2012-02) and (2012-03). Action pending.
Review of manning, training, and resourcing of F&ES at naval shipyards.	Training requirements for F&ES personnel will be expanded to include walkthroughs and incorporate lessons learned. Formal classroom training requirements will be added. F&ES marine training and qualification standards pending. F&ES manning and resourcing assessment action pending.
Investigate personnel tracking systems for non-Fire Department personnel.	Action pending.
Evaluate temporary firefighting system layout and configuration.	Action pending.

4.5. Technology Working Group Action Summary

Technology Working Group	
Item	**Comments**
Implemented requirement to provide for DC CONEX box for submarines in shipyard availabilities.	CONEX boxes store necessary DC gear for a sustained firefighting effort and have been put in place for the USS MIAMI and USS PASADENA. Other shipyard action pending.
Determine the type of hull insulation in use on board all submarines.	Some 688 submarines and all OHIO class submarines have combustible hull insulation in the ER.
Investigate remote sensing and detection technologies for implementation on submarines in industrial availability.	Include automatic fire detection systems, integrated status boards for temporary systems, personnel monitoring systems, PPE, LED lighting systems for personal and ship board use during a casualty, use of temporary non-collapsible hose reels both topside and in-hull, and shipboard automatic sprinkler systems. Action pending.
Evaluate standardization of temporary fire systems.	Action pending.

4.6. Headquarters Response Group Action Summary

Headquarters Response Group	
Item	**Comments**
Develop a final "Fire Safety Requirements" document as well as a plan for mutual aid involvement in major fire drills.	Document will incorporate multiple organization command, control, and communication structure. Action pending.
Issue NAVSEA messages, Ser 004 and Ser 005.	These messages will codify industrial availability DC locker requirements and the implementation of the 45 minute SCBA bottle requirements. Action pending.
Evaluate adequacy of shipboard firefighting doctrine.	Action pending.

[382] USS MIAMI Fire Lessons Learned Flag Oversight Board Charter
[383] NAVSEA 11320 Ser 04R/030 dtd 20 Jul 12
[384] HPD (2012-02)

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APPENDIX A: HISTORICAL TRENDS

A.1. Common Threads

In conjunction with the MIAMI fire review process, the Panel studied Fleet mishaps and trends spanning several decades to gain a historical perspective for overall Fleet DC readiness. This study incorporated mishap information gathered from the NAVSAFCEN, the four naval shipyards, NAVSEA, CNIC, EB Corporation, and various other sources. While not all mishaps reviewed by the Panel revealed a pattern of common or recurring deficiencies, many of them did, suggesting gaps in the processes by which the Navy learns and improves in these areas. The Panel experienced difficulty in obtaining fleet mishap information, related SIRs, Command investigations, and documentation of follow-up actions to these events due to a lack of centralized and accessible Fleet archives, and the absence of a single advocate for DC matters.

Since 1989, there have been 27 Class A fire mishaps in the Fleet.[385] Since 2008, there have been 61 reported fires in public naval shipyards, only 6 of which have required the assistance of Federal firefighters to extinguish.[386] While this data does not necessarily establish definitive trends for the effectiveness of integrated prevention and response efforts, it does indicate two significant points. First, large and mission impacting fires are happening in our Fleet at a rate that demands a steady vigilance toward fire safety, fire prevention, and fire response measures. Second, while most fire prevention measures incorporated into the industrial process have been successful, there is no substitute for an effective fire response if a fire does grow. The experience on MIAMI should serve to drive that point home for years to come.

The following paragraphs catalog 'common threads' between selected Fleet fire mishaps and the MIAMI fire. This analysis was limited due to the availability of documentation on Fleet fire incidents. Consistent with other contributing factors from this report, the common threads are categorized by organization, training, and technology. The following events provide examples of missed opportunities for reducing the severity of the MIAMI fire.

A.1.1. Organizational Factors

The Panel studied seven separate Fleet mishaps spanning from 1984 through 2009 that had organizational themes similar to those outlined in the MIAMI fire. In three recent cases between 2004 and 2009, inadequate rapid response efforts by ship's force and ineffective integration of Federal and mutual aid firefighters contributed to the severity of shipboard fires in port and under new construction. Three cases involved reduced crew compliment and shipboard system configurations which resulted in a reduced margin to safety regarding casualty response.[387,388,389] Two cases between 2007 and 2009 identified inadequate DC communications, including CASCON systems and communications systems between DC parties and DC Central, as critical detractors to the response to the fires. [390,391] The Panel reviewed a 2004 incident from a private shipyard where a drydocked submarine was threatened with in-port flooding when its drydock partially collapsed, noting a critical deficiency in the employment of Navy-wide C2

under circumstances not related to nuclear or radiological matters.[392] The panel also studied four shipboard fire incidents between 1984 and 2009 involving HAZMAT, high energy systems and submarine battery systems which failed and exacerbated the fire. In these cases, integrated responders did not have necessary knowledge, preparation, equipment, and applicable material data information to develop a cogent strategy and combat the casualty.[393,394,395,396]

A.1.2. Training Factors

The Panel studied five separate Fleet mishaps occurring between 2005 and 2009 where training and doctrine deficiencies contributed to the severity of the incidents. In three cases between 2004 and 2009, lack of integrated training and preparation by ship's force and Federal and mutual aid firefighters resulted in extensive shipboard damage and threatened personnel injury when high-energy systems failed, and the seat of the fire could not be readily determined.[397,398,399] One of these incidents specifically highlighted the necessity for in-port casualty training to incorporate effective simulation to add realism for fire responders. Two Fleet fire incidents between 2005 and 2009 identified the need to adopt procedures and systems for active heat and smoke dissipation during in-port fires, similar to those used at sea.[400,401]

A.1.3. Technology Factors

The Panel studied eight Fleet fire mishaps where technology and firefighting equipment performance deficiencies were noted. Two fire incident lessons learned reports from 1994 and 2007 identified SCBA longevity and on board recharge capability as a concern when conditions required sustained firefighting efforts for periods greater than 30 minutes.[402,403] Three fire incident lessons learned reports between 2007 and 2009 identified temperature limitations with FFEs and cited that ready relief crews would be necessary for sustained shipboard casualty response based on expected fatigue and injury.[404,405,406] A new construction fire incident from 2009 identified inadequacy of temporary systems in an industrial environment under ship wide casualty response circumstances, resulting in obstructed access and ineffective CASCON systems.[407] Two cases between 2007 and 2009 identified communications systems between DC parties and DC Central as critical issues for fire response.[408,409] The Panel reviewed three fire casualty reports between 2007 and 2011 that identified a need for smoke detectors, heat detectors, and space monitoring and response system automation under both industrial and at-sea environments.[410,411,412] Two in-port fire incidents from 1997 and 2009 identified the need for improved LED lighting below decks for shipboard fires due the inadequacy of ship's lighting and battle lanterns, noting the superiority of Federal firefighter LED equipment under realistic smoke filled compartment conditions.[413,414] Finally, thermal imager saturation concerns ('red out' or 'whiteout' depending on model of thermal imager) have been reported on at least two Fleet fire investigations from 1997 and 2007.[415,416]

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[385] NAVSAFCEN Supplied Class A Mishap Fire Summary Data

[386] (b) (6) supplied data regarding NAVSEA controlled shipyard fires and Federal FF Response

[387] Command Investigation into the Fire that Occurred on USS WHIDBEY ISLAND (LSD 41) on 5 October 2012
[388] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[389] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[390] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[391] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[392] ECC Lessons Learned from Electric Boat Graving Dock #3 Event
[393] Command Investigation into the Fire that Occurred on USS WHIDBEY ISLAND (LSD 41) on 5 October 2012
[394] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[395] Command Investigation to Inquire into the Circumstances Surrounding the Fire on USS BONEFISH (SS 582) Which Occurred on 24 April 1988
[396] Investigation to Inquire into the Circumstances Connected with a Battery Casualty which Occurred on board USS GUITARRO (SSN 665) on 17 May 1984
[397] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[398] Command Investigation into the Fire that Occurred on USS WHIDBEY ISLAND (LSD 41) on 5 October 2012
[399] Command Investigation into the Circumstances Surrounding the Fire on the Advanced Seal Delivery System (ASDS) on 9 November 2008 at Pearl City Hawaii
[400] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[401] COMSUBRON 2 Recent Inport Fire Lessons Learned 24 February 2005
[402] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[403] Self Contained Breathing Apparatus Refill Capability COMSIXTHFLT Lessons Learned, 1 August 1994
[404] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[405] Command Investigation into the Fire that Occurred on USS WHIDBEY ISLAND (LSD 41) on 5 October 2012
[406] COMSIXTHFLT Relief Crew Needed in Aftermath of VBIED Type Attack on USN Vessel Lessons Learned, 6 October 2007
[407] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[408] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[409] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[410] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[411] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[412] USS STOUT Digital Video Surveillance System Procedures, 24 February 2012
[413] Command Investigation into the Circumstances Resulting in a Fire Aboard LCS 1 at Marinette Marine at Marinette, Wisconsin on 25 April 2007
[414] Fire in Combat Systems Electronics Space COMSUBRON 7 Lessons Learned, 18 April 1997
[415] Command Investigation into the Fire that Occurred On board USS GEORGE WASHINGTON (CVN 73) on 22 May 2008
[416] Fire in Combat Systems Electronics Space COMSUBRON 7 Lessons Learned, 18 April 1997

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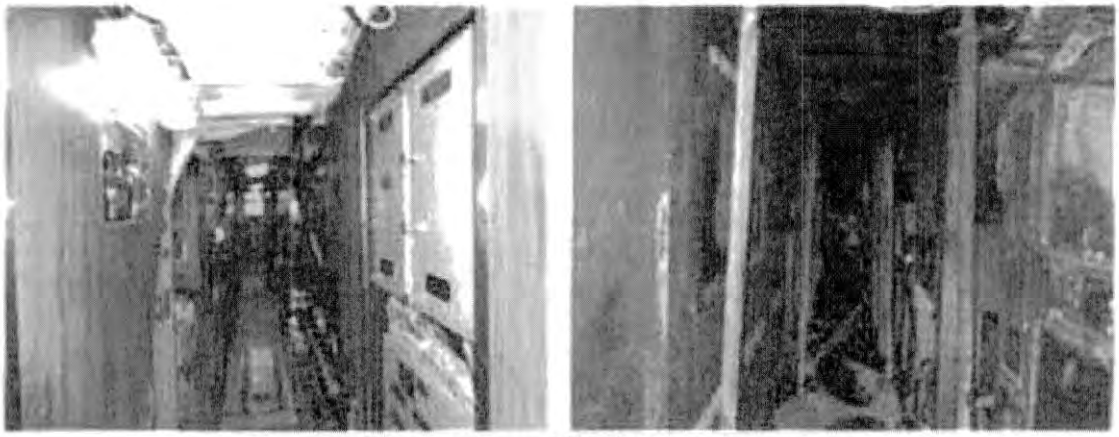
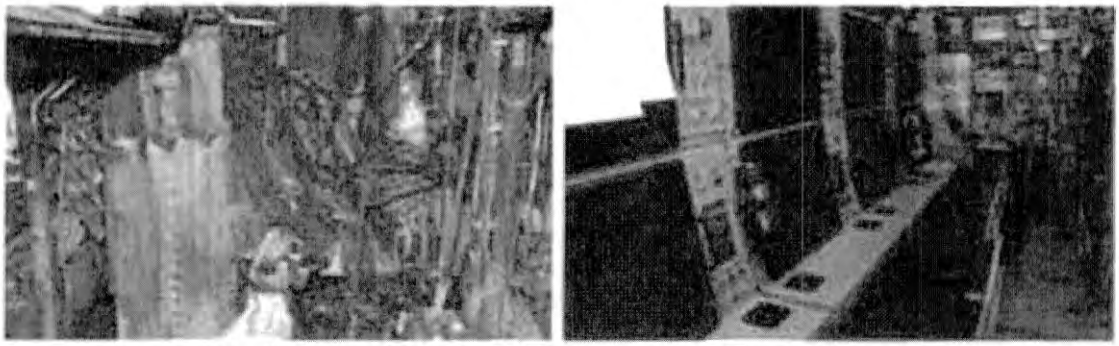
APPENDIX B: IMAGES



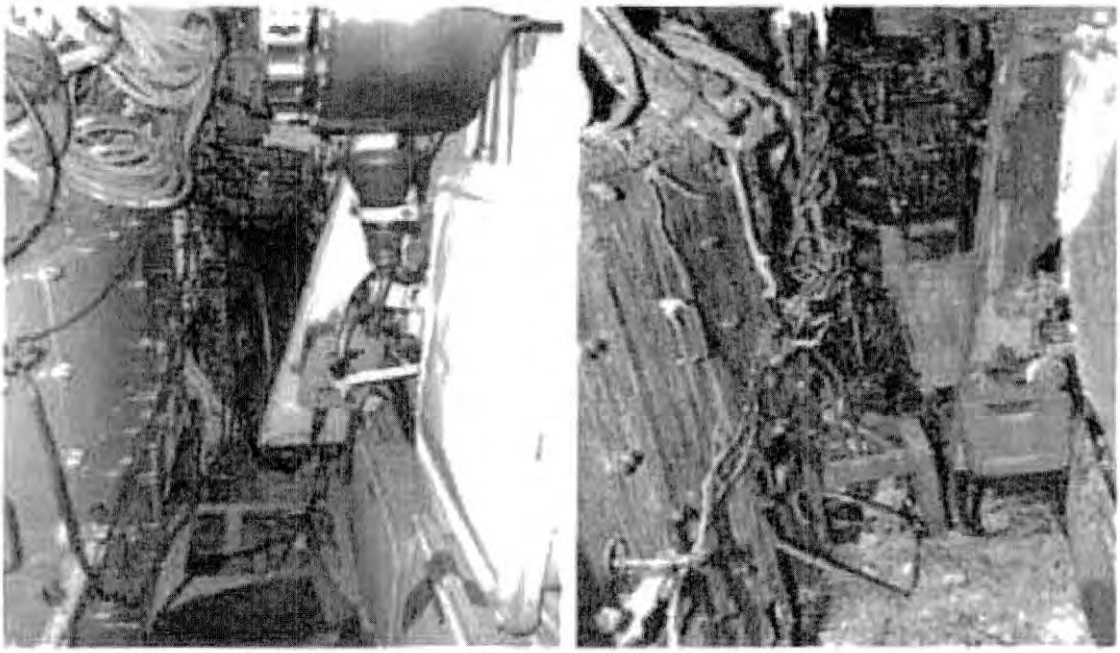
Forward Compartment Middle Level Passageway

Sonar

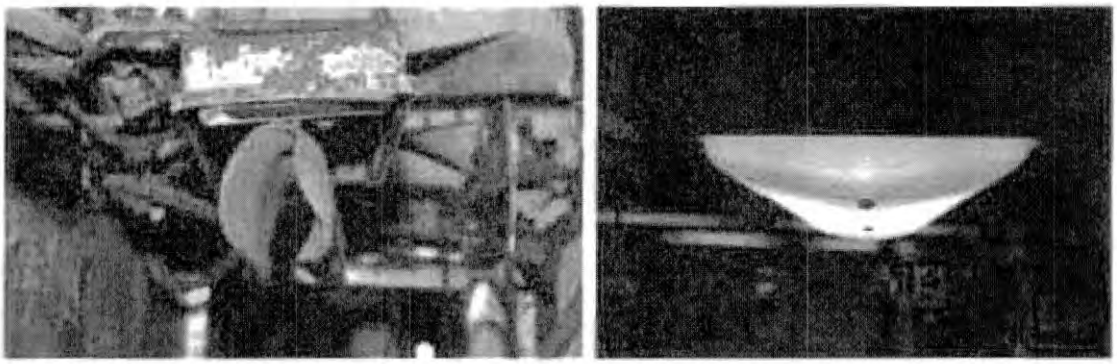


Attack Center (Starboard Forward side of Control Room)

Ballast Control Panel (Port Forward side of Control Room)



Area forward of the Ship Control Panel

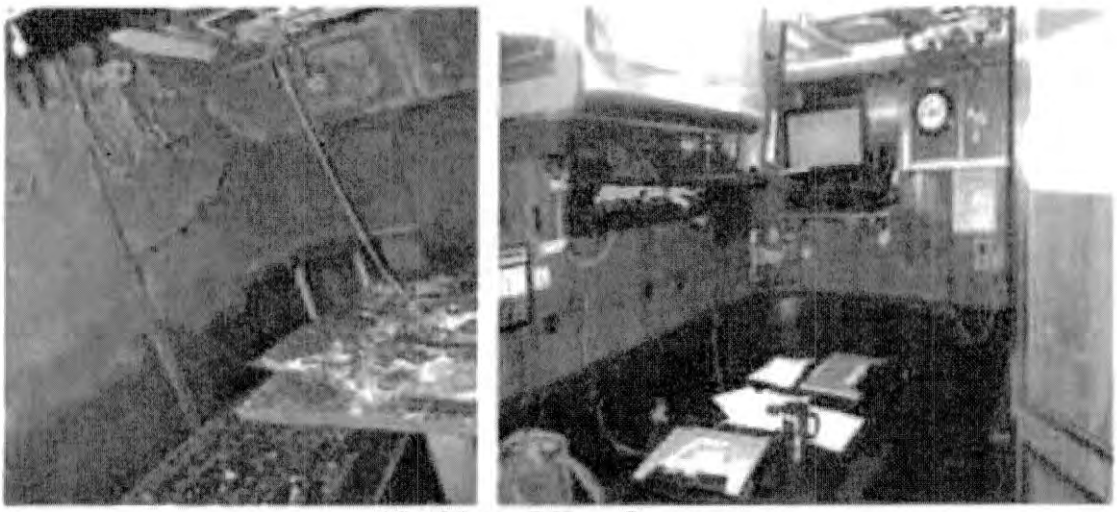


Overhead Light

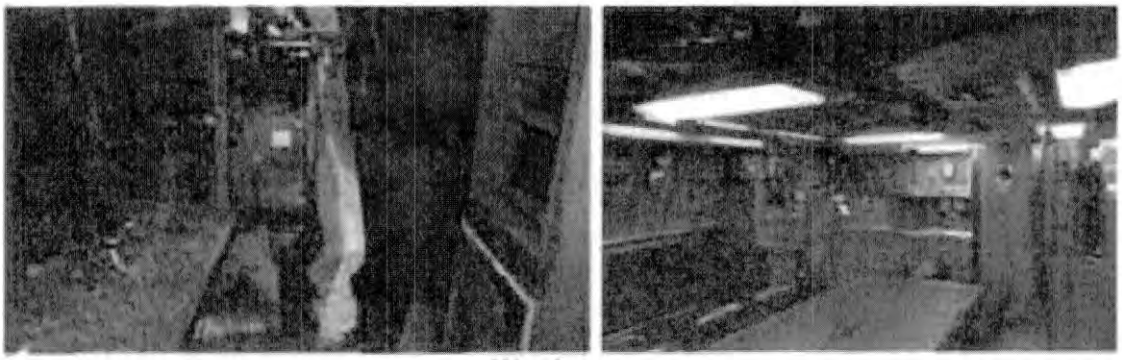
Wardroom Stateroom Passageway

Entrance to the Chief Petty Officer Quarters

Chief Petty Officer Berthing



Chief Petty Officer Quarters



Wardroom

APPENDIX C: REQUIREMENTS ANALYSIS

APPENDIX C: REQUIREMENTS ANALYSIS

	Requirement	Met	Adequate	Recommendations
Ships Requirements	SSAM pre-arrival training	Y	N	3.2.1.1(1)-(3)
	JFMM pre-arrival training	Y	N	3.2.1.1(1)-(3)
	Integrated fire response policy or MOA with fire department and SY	N	N	3.1.2.4.3(2) 3.1.2.4.4(1) 3.1.3.1(1)-(2) 3.1.3.2(5) 3.2.1.4(1)
	Hot-work MOA	Y	Y	
	Hot-work status board	Y	Y	
	Roving watchstander tours of hot-work areas	Y	Y	
	Roving watchstander tours of entire ship	N[1]	Y	3.1.4.1(1)-(4)
	Pier-side tour and pier-side temporary log requirements	Y[2]	Y	3.1.4.1(4)
	Engineering watch supervisory presence on ship	N	Y	3.1.4.2(1)
	One watch officer on board ship at all times	N[3]	Y	3.1.4.2(1)
	CTM/CTQM required SY casualty training and drills	Y	N	3.1.1.1(2) 3.2.1.1(1)-(3)
	Required 6010 drills	Y	N	3.2.1.3(1)-(2) 3.2.1.5(1)-(3),(6)
	Submarine basic firefighting graduates	Y[4]	N	3.2.1.1(1)-(3) 3.2.2(3),(5)
	Submarine advanced firefighting graduates	N[5]	N	3.2.1.1(1)-(3) 3.2.2(3),(5)

1 - BDW was not routinely touring all spaces of the ship.
2 - Ship unnecessarily used the POOD vice the Topside Sentry requiring the BDW presence topside.
3 - This was a COSO requirement, not required by TYCOM.
4 - 138 graduates of 135 required.
5 - 17 graduates of 27 required

	Requirement	Met	Adequate	Recommendations
Fed Fire Requirements	Initial Certification	Y	N	3.1.2.4.1(1)-(2) 3.2.1.2(1)-(2)
	Live fire training	N	N	3.1.2.4.1(2),(6) 3.2.2(1)-(3)
	Shipboard familiarization training	Y[1]	N	3.1.2.4.1(3) 3.2.1.5(4)-(5)
	Physical readiness standards	Y[2]	N	3.2.1.2(5)
	Shipboard weekly fire prevention inspections	N[3]	N	3.2.1.5(4)
	NFPA marine firefighting certification and training requirements	N	N	3.1.2.4.1(2)
Firefighting On board MIAMI	NSTM 555 doctrine	N[4]	N	3.2.1.5(2) 3.2.1.1(1)-(3) 3.2.1.4(2)
	SSM CP62-5	N[5]	N	3.2.1.5(2) 3.2.1.1(1)-(3) 3.2.1.4(2)

1 - Shipboard familiarization training only required for EMT personnel. Not required for firefighters.
2 - Physical readiness standards only apply for initial qualification.
3 - Report and record of attendance not completed.
4 - Person discovering the fire did not ensure location was known by all personnel. Methodical search for the source of fire conducted. Fire hoses should be removed from a space if abandoning the space. All efforts shall be made to ensure face to face turnover of hoses is performed to ensure continuous application of water.
5 - BDW, SEO and SRW will immediately respond to the casualty with portable fire extinguisher, the BDW did not respond. SDO shall report to scene of the fire as the man in charge, the SDO failed to report to the scene as the man in charge. No individual should attempt to combat a large fire without assistance since personnel casualties compound the existing casualty situation.

	Requirement	Met	Adequate	Recommendations
Organizational	NAVSAFCEN distribute SIRs	Y	N	3.1.1.1(1)
	Adjudicate/track SIR recommendations	N	N	3.1.1.1(2)
	Command investigations retained at central location	N	Y	3.1.1.1(3)
	NAVSEA safety directives for industrial availabilities consistent and clearly articulated	N	N	3.1.2.4.1(1) 3.1.3.1(1)
	NAVSEA follow-up on urgent NSRO recommendations	N	N	3.1.3.2(1)-(3),(6)
	Local SY fire safety plans and fire response policies in compliance with higher directives	N	N	3.1.3.1(2)
	Crew presence on ship in industrial environment	N	N	3.1.4.1(1) 3.1.4.2(1)
	Relationship between NIMS IC and CO	N	N	3.1.5(1)-(5)
	Non-nuclear casualty C2	N	N	3.1.6.1(1)-(3) 3.1.6.2(1)
	Life cycle management of fleet live fire training facilities	N	N	3.2.2(4)
	Incorporation of fleet lessons learned into fleet and pipeline live fire training	N	N	3.1.1.2(3) 3.2.2(3)

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APPENDIX D: CONSOLIDATED LIST OF RECOMMENDATIONS

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Fleet Commanders

(1) Fleet Commanders review content and periodicity of training mandated by echelons higher than TYCOMs to ensure COs are not hindered in maintaining focus on the "main thing".

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TYCOMs

(1) TYCOMs review directives regarding shipboard watches and minimum shipboard duty section presence during industrial availabilities.

(2) TYCOMs review guidance for modifications to watches that may result in reduced below decks roving presence.

(3) TYCOMs review directives to ensure that the number of roving watchstanders will maintain the required posture for the ship during all circumstances and conditions.

(4) TYCOMs consider providing guidance for adding compartment safety and security check requirements to roving watchstander logs to provide a checklist for thorough hourly compartment tours. COs and watch section supervisors must continuously emphasize the need for thorough tours by roving watchstanders, even to areas with no active ship's systems.

(5) TYCOMs evaluate for an appropriate reduction in shipboard AT/FP posture. With the shipyard being a CIA with its own external security, a reduction to ship's force watch requirements should be considered.

(6) TYCOMs review the justification for temporary off-hull WRs, and the possibility of maintaining temporary shipboard berthing for at least one Duty Officer.

(7) TYCOMs update Surface and Submarine CO qualification and training procedures to require training on the relationship of the CO and the NIMS IC.

(8) TYCOMs assess the adequacy of DC related shipboard training requirements, particularly during major availabilities, to reflect an appropriate emphasis on DC capabilities. – In progress, NAVSEA Industrial Process Working Group

(9) TYCOMs establish qualification standards to mandate that personnel charged with shipboard DC responsibilities demonstrate appropriate knowledge and individual skill prior to any potential casualty response assignments.

(10) TYCOMs coordinate with NAVSEA and CNIC to align applicable directives to establish a requirement for incorporating various casualty scenarios, including worst case conflagration events necessitating Federal and mutual aid F&ES response, into periodic shipboard training programs.

(11) TYCOMs evaluate all reasonable means to improve realism in shipboard fire training.

(12) TYCOMs coordinate with appropriate training commands to evaluate the adequacy of their respective live fire devices versus commercial state-of-the-art trainers. As appropriate, apply modifications and improvements to all live fire devices.

(13) TYCOMs coordinate with appropriate training commands to establish requirements for live fire training curricula to incorporate written and practical examinations, with skill demonstrations assessed with objective grading standards. Additionally, live fire instructors should participate in professional development activities such as civilian firefighting information sharing forums.

(14) TYCOMs coordinate with appropriate training commands to evaluate the adequacy of their respective live fire course content and execution. Areas which this review should consider for improvement include, but are not limited to:

Effects of heat stratification

- Impact of heat and water on PPE performance
- High temperature approach tactics
- Fire location identification tactics
- SCBA bottle re-charging
- Re-entry considerations, including fatigue and firefighting rehabilitation
- Student knowledge and skill assessment
- Varying response scenarios
- Course update criteria, including lessons learned

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APPENDIX E: ITEMS EXAMINED AND DISMISSED

Throughout the Panel's investigation, many organizational, training, and technology factors surrounding the MIAMI fire were evaluated. A broad approach was taken to comprehensively indentify areas for improvement. During this process, two areas were assessed and found to be adequate. These areas are AT/FP watchstanding demands conflicting with shipboard watch requirements, and fire survivability for new construction ships using advanced materials.

Early in the investigation, the Panel interviewed Fleet personnel who expressed concerns that AT/FP watchstanding requirements place a disproportionate demand on their duty sections, and detract from focusing on other duties, including DC. In the MIAMI fire, the CO had established a policy that allowed the BDW to assist topside watchstanders in their AT/FP related duties, detracting from his in-hull roving presence. However, current directives would have allowed the CO to accomplish the same through other mechanisms that would not have detracted from the BDW duties. As a follow-up the Panel conducted a thorough review of Fleet AT/FP requirements for each ship class and concluded that current policy does not place a disproportionate demand on ship crews. Recent initiatives to leverage installation AT/FP resources in meeting overall requirements have reduced the AT/FP watchstanding loading on ships in port and in availability.

The Panel studied fire survivability criteria for several classes of ships, including aluminum hulled Littoral Combat Ships (LCS) and composite hulled ZUMWALT class destroyers, new construction projects incorporating advanced material design. Based on the post-fire concern for MIAMI's hull integrity, a careful review was warranted to ensure that in-service and future ship design standards were adequately codified. The Panel concluded that fire survivability standards are adequate for Navy ships. Specifically, the hull fire criteria for ships that were studied is based on a 30 minute fire rating (able to withstand post-flashover fire temperatures for a minimum of 30 minutes), and is independent of hull construction material. This criteria required the adaptation of advanced design fire insulation for LCS and ZUMWALT. The Panel concluded that there are no unique concerns for these new classes of ships. In the view of the Panel, the more significant concern lies with older classes of ships that use combustible hull insulation, as outlined in section 3.3.7.

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APPENDIX F: INTEGRATED RESPONSE SCENARIO

BACKGROUND

The Panel concluded that the best opportunity to minimize the magnitude of and subsequent damage from a major in port or industrial activity fire is a fully integrated response between ship's force, Federal firefighters, and mutual aid (if requested). However, existing doctrine does not address the manner in which integration should occur. This appendix provides a notional model outlining the manner in which an integrated response to a shipboard fire might unfold. Note that this scenario does not incorporate any complications potentially arising from high energy systems, HAZMAT, or emergency medical services.

ASSUMPTIONS

1. Ship's force is manning a naval vessel in port or an industrial activity. Only duty section personnel are on board. Personnel from external maintenance organizations may or may not be present.
2. Either permanently installed or temporary shipboard casualty announcing systems are available.
3. Both ship's force and repair activity personnel are trained to recognize and respond to shipboard casualties.
4. Either the CO or an individual designated to act in lieu of the CO are in the vicinity of the ship and can arrive within a reasonable period of time (~30 minutes).
5. The fire is of sufficient magnitude that neither immediate nor intermediate responses extinguish the blaze.
6. The ship is equipped with portable fire extinguishers and the rapidly deployable, intermediate capacity fire hoses discussed in section 3.3.2.5.
7. Water is readily available on the ship, pier, and/or dry dock quay wall to support sustained fire hose response.
8. Capacity to fully equip ship's force with personnel protective equipment exists on the ship or in its immediate vicinity. This equipment includes the personnel accountability equipment discussed in section 3.3.3.5, a motion detection system discussed in section 3.3.2.3, hand's free LED lighting discussed in section 3.3.3.4, and firefighting helmets and boots discussed in section 3.3.3.3.
9. The ability to re-charge ship's force, Federal firefighter, and mutual aid SCBA bottles exists on the ship or its immediate vicinity.
10. One or more Federal fire houses are available to support ship's force DC efforts.
11. Federal firefighters are certified and trained to combat shipboard fires and have familiarity with shipboard configurations. However, this familiarization is insufficient to allow Federal firefighters to navigate through a ship in reduced visibility conditions without ship's force escort.
12. Mutual aid, if available, is invoked per pre-existing casualty response plan(s).

13. Mutual aid firefighters may or may not be certified and trained to combat shipboard fires and have no familiarity with naval vessel configurations.
14. Pre-existing casualty response plan(s) and remote shipboard access and temporary system status, if applicable, is available to Federal firefighters prior to the fire.
15. An ECC or EOC are activated to support on scene casualty response efforts, higher authority reporting, and public affairs.
16. As discussed in sections 3.1.2.2 and 3.3.2.3, a wireless communications system in-hull, in the immediate vicinity of the ship, and EOC or ECC provides seamless communications between all responders and those individuals in supporting roles. This communications system will be one of several employed by the EOC or ECC.
17. A location from which on-scene DC efforts can to be coordinated is designated per pre-response planning. This controlling station is either aboard ship (e.g., DC Central) or in its immediate vicinity (e.g., topside CASCON shack), but in all cases must possess ship's announcing system functionality, a wireless communications circuit, a status of ship access points and temporary systems (if applicable), telephones, and appropriate doctrine and equipment schematics. If not located on board, a megaphone or similar device should also be available at the controlling station.
18. A personnel accountability system in the immediate vicinity of the ship is available for ship's force, Federal firefighters, and mutual aid responders.
19. Differences between ship's force and Federal firefighter personnel protective equipment, firefighting equipment, doctrine, and tactics are minimized such that hose teams can be effectively integrated.

SCENARIO

1. The fire ignites and is discovered by either ship's force watchstanders or repair activity personnel. Announcements are made at the scene and are repeated via the shipboard casualty announcing system.
2. Watchsection supervisors ensure local Federal firehouse(s) and ship's command element are informed of the casualty. Both Federal firefighters and the ship's command element proceed rapidly to ship.
3. Casualty notification is provided to the installation or shipyard Command Duty Officer, who subsequently informs the appropriate chain of command. Based on the assessed extent of the casualty, the installation or shipyard CO directs activation of the EOC for events aboard non-nuclear vessels or the Emergency Command Center (ECC) for events aboard nuclear vessels. If both EOC and ECC are established, EOC assumes a subordinate, supporting role.
4. Repair activity personnel egress the ship. Those personnel with knowledge of the location, source, or magnitude of the fire or nature of injuries provide this information to ship's force supervisors at the controlling station prior to departing the immediate vicinity of the ship. The ship's access control watch actively engages departing repair activity personnel for information on the fire.
5. Ship's force watchstanders *immediately* respond to the fire. This response occurs without breathing protection or PPE. As a minimum, immediate response employs portable fire

extinguishers, attempts to isolate the source of the fire, includes a report of initial efforts to combat the casualty (including injuries), and establishes an initial in-hull man-in-charge. Communications during immediate response employ general announcing circuits (e.g., 4MC, CASCON, etc.). Personnel accountability during this stage occurs using the ship's watchbill. After immediate response to the casualty, the location of the fire may be unknown or unclear. In this notional scenario, the fire continues to burn after immediate response.

6. Ship's force conducts *intermediate* response to the fire. This response occurs with breathing protection, personnel protective equipment, and a rapidly deployable, intermediate capacity fire hose. Designated watchsection supervisors and available off-watch personnel conduct intermediate response and establish wireless communications with the controlling station. If required, follow-on attempts to isolate the source of the fire and address injuries occur during this stage. Personnel accountability occurs using the ship's watchbill. After intermediate response to the casualty, the location of the fire may remain unknown or unclear. Therefore, designated ship's force personnel with breathing protection, personnel protective equipment, and thermal imaging equipment conduct a systematic search of the vessel for the seat of the fire and injured personnel during intermediate response. In this notional scenario, the fire continues to burn after intermediate response.
7. After intermediate response is complete, the "two-man rule" is now in effect, requiring that no individual respond to the casualty or proceed in-hull without a 'buddy' and entry into a personnel accountability system
8. During the intermediate response phase, the initial in-hull man-in-charge will probably be relieved by a watchsection supervisor, the XO, or a department head. Reliefs to the initial in-hull man-in-charge should be equipped with SCBAs and personnel protective equipment. Continued relief of the in-hull man-in-charge will likely occur throughout the casualty due to SCBA exhaustion.
9. In parallel with intermediate fire response, a controlling station is established. Designated watchsection supervisors man this controlling station until relieved by appropriate members of the command element, preferably the CO. Wireless communications are established between the controlling station and scene. The controlling station commences execution of a hose attack and ingress plan that ensures a continuous application of extinguishing agent. The controlling station also coordinates long-term support to the scene; ensures appropriate systems (permanently installed or temporary) are de-pressurized, isolated, or de-energized; establishes pre-designated communications circuits with the EOC and/or ECC, and ensures required reports to higher authority occur. Using a megaphone or other similar device, the CO periodically provides those in the vicinity of the controlling station casualty updates. Shipboard heat/temperature sensors are remotely monitored to ensure that efforts remain focused on locating/attacking the seat of the fire.
10. Federal firefighters arrive at the scene. Firefighters begin to deploy hoses and don equipment, as necessary. The senior fire officer proceeds to the controlling station and reports to the CO (or designated representative) as the NIMS on-scene IC. Although under operational control of the CO, the senior fire officer retains direct control of Federal firefighting resources. The senior fire officer receives remote updates in the fire house, and updates in route to the fire. He receives a brief casualty status update from the CO. The senior fire officer commences

supporting actions directed by the CO, ensuring wireless communications are established between ship's force responders, Federal firefighters, and the controlling station.

11. Repair activity supervisors (e.g., Project Manager) arrive at the controlling station and report to the CO. As directed by the CO, repair activity supervisors de-pressurize, isolate, or de-energize appropriate temporary systems and bring additional repair activity assets to bear on the casualty.
12. If intermediate response efforts fail to extinguish the fire, the controlling station commences a recall of all ship's force personnel and requests assistance from nearby vessels. All watchsection personnel not otherwise designated or engaged in casualty response rapidly don SCBAs, personnel protective equipment, and commence forming integrated hose teams with Federal firefighters. Nearby vessels provide additional personnel and DC equipment. Longer duration SCBA bottles (45 minutes or greater) are used to the maximum possible extent.
13. When wireless communications are confirmed with the controlling station, hose teams manned by an integrated mix of ship's force and Federal firefighters commence their ingress to the casualty scene. While performing any hose team function (e.g., nozzle, hose, etc.), a crewmember provides the team the direction necessary to reach the effected space. Due to the constrained nature of shipboard environment and the need to proceed to the scene rapidly, the hose initially remains depressurized. However, as the scene is approached or if otherwise required, the hose is pressurized, the nozzle tested, and the team continues its advance. Status of the hose team is periodically reported via wireless communications to the controlling station and the on-scene man-in-charge. Personnel accountability of hose team personnel occurs using an appropriate system per the pre-determined response plan.
14. During the initial portion of this stage of the casualty, the location of the fire may remain unknown or unclear. As a result, multiple hoses teams and access points may be required.
15. With hose teams advancing on the fire, the controlling station in place, and wireless communications established, the EOC and/or ECC comes on line. Monitoring communications from the controlling station, the EOC and/or ECC coordinates additional assets, ensures higher authority reporting requirements are satisfied, invokes mutual aid per pre-determined response plans, and prepares public affairs releases. In this notional scenario, EOC and/or ECC requests mutual aid.
16. It cannot be assumed that the first set of hose teams will extinguish the fire. Therefore, follow-on hose teams must be assembled and don personnel protective equipment in such a manner that in-hull hose teams are relieved prior to their SCBA exhaustion. Hose team planning and execution must ensure that continuous extinguishing agent is applied to the fire and hoses are never left unattended. Additionally, heat stress and individual rehabilitation must be factored into hose team planning. In this scenario, firefighters consume pre-staged bottled water to reduce rehabilitation time.
17. Mutual aid begins to arrive. Since these individuals are not familiar with shipboard configurations, the Federal senior fire officer directs mutual aid responders to perform appropriate off-hull tasks (e.g., fire truck operations, SCBA re-charging, topside hose routing, etc.). Mutual aid might also be able to provide equipment not otherwise available, such as airport runway foaming trucks.
18. In particularly severe casualties, extraordinary means (e.g., dry dock flooding, abandonment, etc.) might be required to save lives or the vessel. Ultimately, the decision to employ

extraordinary means rests with the CO. However, the senior fire officer, repair activity leadership, and EOC or ECC will likely provide significant technical information to support this decision.

19. When the fire is extinguished, post-casualty actions such as stationing reflash watches, venting and de-smoking, de-watering, and atmosphere sampling occur in a controlled manner per published doctrine and instruction.

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APPENDIX G: REPAIR ASSESSMENT

DEPARTMENT OF THE NAVY

NAVY WARFARE DEVELOPMENT COMMAND
1528 PIERSEY STREET
NORFOLK, VA 23511-2723

5800
Ser N00/174
7 Aug 12

From: Commander, Navy Warfare Development Command
To: Commander, U.S. Fleet Forces Command

Subj: USS MIAMI (SSN 755) REPAIR PLANNING AND PROGRESS

Ref: (a) USFF ltr Ser N00/128 of 25 Jun 12

1. This letter forwards the initial independent Fire Panel assessment of the USS MIAMI (SSN 755) repair planning and progress efforts to date, as directed by reference (a).

2. The Panel is reviewing daily status reports from the Portsmouth Naval Shipyard Project lead, and keeping abreast (attending where possible) of NAVSEA informational and decision briefs on MIAMI's repair plan. NAVSEA is leading a combined team, including Electric Boat, Newport News Shipyard, and Portsmouth Naval Shipyard. The sense of the Panel is that the right group of activities and experts are involved at this point.

3. The Panel has added (b) (6), an Engineering Duty Officer with extensive submarine and regional repair experience, to enable independent evaluation and reporting from Portsmouth Naval Shipyard. (b) (6) has been tasked with maintaining a high level of situational awareness as a subject matter expert while providing an objective point of evaluation for the overall corrective action and repair effort. He will remain at Portsmouth Naval Shipyard for the duration of our assessment.

4. With respect to recoverability of the ship, many unknowns remain. Engineering assessments of damage to the ship's hull, hull castings, and Forward Compartment internals are in progress. Complete testing of the hull samples is not expected to be complete until late September/early October, but an initial set of representative samples have been analyzed, and the results are trending toward the recoverable end of the spectrum. Although the damage to the ship's internals is extensive, given Navy's past experience with USS SAN FRANCISCO (SSN 711), the sense of the Panel is that with proper resourcing (funding, manpower, and time), all of those challenges will be

surmountable. The final engineering assessment of the Forward Compartment internals is contingent upon completion of the "ripout" phase of the damaged areas, and is not expected to be complete until December. Cost estimates will depend on the split of the work between the government and private shipyards, and are currently in progress at Naval Sea Systems Command.

5. The Panel concurs with the NAVSEA position that the limiting factor for repair feasibility determination will be the results of the hull and hull casting destructive and non-destructive testing. Given satisfactory completion of that testing, and no additional major internal system replacements identified from the internal engineering assessments, we feel that the ship can be returned to an operational status within the shipyard's current estimate of one additional year added to the availability.

T. B. KRAFT

DEPARTMENT OF THE NAVY
NAVY WARFARE DEVELOPMENT COMMAND
1528 PIERSEY STREET
NORFOLK, VA 23511-2723

5800
Ser N00/199
10 Sep 12

From: Commander, Navy Warfare Development Command
To: Commander, U.S. Fleet Forces Command

Subj: USS MIAMI (SSN 755) REPAIR PLANNING AND PROGRESS

Ref: (a) USFF ltr Ser N00/128 of 25 Jun 12

1. Currently the major focus of production work is the removal of piping and structural interference in support of the damage assessment to the hull, electrical cabling and mechanical components. Currently there are NAVSEA approved assessment plans to conduct the assessment of electrical cabling and mechanical components. The shipyard is actively pursuing completion of the mechanical assessment plan. Additional resources from Electric Boat Corporation will begin assisting in this effort starting 5 September 2012. The electrical assessment plan is currently on hold due to technical questions raised by Electric Boat Corporation.

2. Portsmouth Naval Shipyard is currently collaborating with Electric Boat Corporation to finalize a plan, for NAVSEA approval, to certify the hull for further use. The certification plan is on track to be submitted for NAVSEA's approval on 9 September 2012. The lack of an approved plan is not holding up data gathering for hull certification. The shipyard is actively engaged in obtaining hull plate and frame hardness readings, performing hull casting magnetic particle testing (MT), removing hull samples, known as Trepan Samples, for destructive tensile strength testing and obtaining frame web and flange deflection angles. Additionally, the shipyard has begun development of a laser based process to assess the hull structural fairness in support of the hull structural analysis. The estimated completion date for completing all fire assessment inspections, including the hull, is 27 November 2012.

3. The next major production work to begin is the removal of the approximately 500 square feet of the Forward Compartment Upper Level (FCUL) deck that buckled due to the intense heat of the fire in middle level. The shipyard is currently engineering this work and will send their plan to the Planning Yard for review on 20 September 2012.

4. The current repair plan is for Electric Boat Corporation to restore the first and second platform of the USS MIAMI while

Subj: USS MIAMI (SSN 755) REPAIR PLANNING AND PROGRESS

Portsmouth Naval Shipyard will be responsible for completing all other assigned EOH work. Additionally Portsmouth Naval Shipyard will restore the third platform. Currently, there is a contract in place with Electric Boat Corporation to perform limited pre-planning and purchase long lead time material. To execute this plan, NAVSEA intends to enter into two additional contracts with Electric boat. The first contract for approximately $96 Million will be for engineering and planning services. The second contract is for actual production work with an estimated value of $300 Million. Portsmouth Naval Shipyard and Electric Boat Corporation are in ongoing weekly discussions to finalize the division of work between the two organizations. PMS 392 plans to award the planning contract by the end of September 2012. PMS 392 plans to award the $300 Million production contract in March 2013 to support major on site production work by Electric Boat Corporation in July of 2013.

5. During the next 30 days, the shipyard will continue to gather data for the hull certification, start rip out of the FCUL deck, and continue with the mechanical and electrical component assessments. Additionally, chloride removal of lower level piping and structure will begin as will preservation of the areas of the hull that were not affected by the fire. Discussions about work division between Electric Boat Corporation and the shipyard will continue.

6. It is the assessment of the Panel that to date Portsmouth Naval Shipyard is restoring the USS MIAMI (SSN 755) as fast as available resources and funding will allow. Additionally, the correct organizations have been involved in the restoration of the USS MIAMI (SSN 755). Specifically, Portsmouth Naval Shipyard, Electric Boat Corporation and NAVSEA are collaborating closely to develop a plan. Additionally, Portsmouth Naval shipyard is using available money to contract with technical experts, Original Equipment Manufacturers (OEM) and the right level of skilled labor to increase the resources available to restore the USS MIAMI (SSN 775).

7. It is the opinion of the Panel that based on currently available information there are no conditions on board the USS MIAMI (SSN 775) that cannot be repaired. To date there have been some out of specification hull hardness, frame web and flange deflections, and hull circularities noted. However, all destructive testing performed to date has shown no degradation of the strength of the hull. While final engineering analysis of all the data will likely not complete until early 2013, any

repairs that would be necessary to correct these deficiencies are well within the capability of the maintenance activities involved.

8. Repair timeline estimates are under development based on current resourcing and scope of work projections and indicate a completion date for MIAMI in mid-2015. The current man-day estimate for the ship's restoration is between 200,000-250,000 man-days, which is essentially adding another unscheduled EOH-equivalent work load to the submarine repair enterprise. NAVSEA is evaluating short-term and long-term resourcing options, including additional outsourcing of scheduled availabilities to Electric Boat as a mechanism to absorb the additional work load. Further fidelity is required from these plans to solidify a realistic repair completion date.

9. It is the opinion of the Panel that there are two areas where additional NAVSEA assistance would benefit the repair effort. First, PMS 392 needs to develop a contracting strategy that will have Electric Boat Corporation production resources available by March of 2013 to support off site pre-fabrication work and on site resources to support rip out and FCUL deck work. Otherwise, there will not be resources available at the shipyard to continue production work on the fire recovery. One lesson learned from the repair of the USS SAN FRANCISCO (SSN 711) is that once production work stops on a repair of this magnitude, it is nearly impossible to regain momentum and meet schedule. Secondly, the off yard approval process for technical documents needs to be streamlined. Based on the observations of the Panel's on site representative, it appears that NAVSEA has provided little input into developing these documents. As a result there is a long back and forth negotiation between Shipyard Engineering and NAVSEA before an approved document is signed. One case of this is the Electrical Assessment Plan. On 21 August, the plan was approved, without comment, by NAVSEA. On 23 August Electric Boat Corporation engineering raise additional questions about the plan. As of 31 August, Portsmouth Naval Shipyard is still working to resolve these concerns. If this process is allowed to continue unchecked, there is a high likelihood that key technical documents, such as the Hull Certification Plan, will not be ready in time to support an on time completion of this availability.

T. B. KRAFT

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APPENDIX H: ADMINISTRATIVE MATTERS

The MIAMI Fire Panel investigation was appointed on 25 June 2012 with direction to provide a comprehensive report to the Commander, Fleet Forces Command within 60 days of receipt of the basic report for the underlying NAVSEA-appointed JAGMAN investigation. The JAGMAN basic report was initially issued on 12 July 2012, but was rescinded and reissued on 25 July 2012 to incorporate intervening evidence developed by the NCIS investigation involving the criminal suspect who confessed to intentionally starting the MIAMI fire.

The appointing order was amended on 11 September 2012 to extend the suspense date until 1 October 2012 based on a Panel request for additional time to inquire into matters discovered during the investigation. By separate correspondence on 20 September 2012, Panel member (b) (6) was excused.

All Personal Identifying Information contained in the report that is subject to protection under the Privacy Act was obtained from existing records.

The Panel did not receive or review any privileged matters from a parallel safety investigation that was initiated, but later suspended after a criminal cause to the fire was identified.

All personnel interviewed who reasonably may have provided privileged statements were advised that the Panel did not have access to and would not review any privileged statements or derivative information from the safety investigation. Additionally, the Panel ensured that military personnel interviewed, as appropriate, were properly advised of their Article 31(b) rights under the Uniform Code of Military Justice.

Pursuant to the appointing order, the evidence gathered and findings of fact from the JAGMAN basic report served as a foundation to the Panel investigation. The JAGMAN report is currently pending review by Commander, Navy Region, Mid-Atlantic and successive endorsers. Although JAGMAN fact finding served as a foundation, the Panel's fact finding, opinions and recommendations are independent from the JAGMAN investigation and should not be considered as an endorsement of the JAGMAN report.

All references and memoranda generated during the investigation and cited in the section end notes of this report have been retained on a secure internet portal at Navy Warfare Development Command. Requests for access to these records may be submitted via the following uniform resource locator: http://portal.nwdc.navy.smil.mil/MIAMI/.

The Panel wishes to acknowledge the following personnel assigned to assist the Panel:

(b) (6)	COMSUBPAC
(b) (6)	Office of Naval Intelligence
(b) (6)	Trident Refit Facility, Kings Bay
(b) (6)	Office of Naval Research
(b) (6)	PERS-42
(b) (6)	Navy Warfare Development Command
(b) (6)	CNRSW Regional Fire Chief

The Panel also benefitted from legal support including research, opinions and reviews from the following personnel:

(b) (6)	Office of the Judge Advocate General
(b) (6)	Region Legal Service Office Mid-Atlantic
(b) (6)	Region Legal Service Office Mid-Atlantic
(b) (6)	Region Legal Service Office NDW
(b) (6)	Region Legal Service Office NDW
(b) (6)	Region Legal Service Office Mid-Atlantic

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5800
Ser N00/128
25 Jun 12

From: Commander, U.S. Fleet Forces Command
To: RADM Terry B. Kraft, U.S. Navy

Subj: USS MIAMI FIRE REVIEW PANEL

Ref: (a) Manual of the Judge Advocate General, Chapter 2

1. On 21 May 2012, a fire onboard USS MIAMI (SSN 755) caused extensive damage to the forward compartment of the submarine. At the time, USS MIAMI was undergoing a 20-month maintenance availability at the Portsmouth Naval Shipyard. The fire started on the evening of 23 May and was extinguished early in the morning on 24 May by the crew, Portsmouth Naval Shipyard Fire Department personnel, and local and out-of-state fire departments. No one was seriously injured and the submarine's nuclear propulsion spaces were not affected by the fire. There is extensive damage to USS MIAMI and assessments on the integrity of the hull are in progress. Repairs will require overlapping involvement of multiple organizations to restore USS MIAMI to full service. The Naval Criminal Investigative Service (NCIS) conducted an initial investigation. Commander, Naval Sea Systems Command (NAVSEA) convened a command investigation pursuant to reference (a) and a safety investigation, both of which are currently in progress.

2. Given the magnitude of the damage and the overlapping involvement of multiple organizations, you are directed to convene and lead a USS MIAMI Fire Review Panel to conduct a comprehensive examination of all aspects of the events leading to the fire and the response to the fire, including organizational factors and command and control, that may have contributed to the seriousness of the fire and the extent of the damage. You are directed to establish your review panel upon receipt of this letter in order to develop a Plan of Action and Milestones for your review; however, you shall not formally begin your review until the command investigation has been signed by the investigating officer. The panel shall review the NAVSEA command investigation, the NCIS findings, and any other available information necessary to obtain a complete understanding of the event, including conducting additional interviews and collecting additional documentation. Facts established in the command investigation are to be presumed as valid unless there is reliable evidence to the contrary.

3. Not later than 60 days after you receive a copy of the signed command investigation into the fire, you are directed to provide a

comprehensive report that includes, but is not limited to, findings in the following areas:

a. Identify and fully explore the root causes of the fire. Determine the susceptibility of a submarine at sea or in port (but not in maintenance availability) to a similar fire casualty. Determine the adequacy of current submarine firefighting and damage control equipment.

b. Determine if the basic firefighting requirements of NSTM 555 VOL II are adequate.

c. Determine if the current emergency response processes and procedures, training and organizational alignments across all naval maintenance activities are adequate. Identify organizational factors relevant to this incident, including command and control and the interaction among organizations responsible for emergency response, and how the factors did or did not contribute to the response to the fire. Specific questions to address include:

(1) Are current training requirements for submarine complex casualty response adequate prior to a ship entering the shipyard environment?

(2) Are the coordinated training requirements for all activities adequate for complex casualties; specifically, initial classroom training, drills, and continuing training?

(3) Determine the effectiveness of the National Incident Management System (NIMS)/Incident Command System (ICS) directed under the National Response Plan and used by Fire and Emergency Services Department vice Shipyard organizational command and control processes.

(4) Determine if firefighter safety was compromised during the firefighting efforts and, if so, what caused it.

d. Determine the adequacy of current Commander, Navy Installation Command (CNIC) fire and emergency services and firefighting and damage control equipment across all relevant naval maintenance activities.

(1) Specifically evaluate communication equipment, thermal imaging, self-contained breathing apparatus, and fire hoses.

(2) Determine those elements of casualty identification and response that may be improved with technology (e.g. remote sensors for heat, pressure, remote cameras and fire suppression).

e. Determine if the specifications for cleaning gear (e.g. vacuums) and cleaning practices authorized for use in all maintenance environments are adequate.

f. Determine if fire watch procedures, hot work permit procedures, and work site clean-up procedures following hot work are adequate.

g. Determine if the evolution of inport submarine watch organization requirements, especially in the industrial environment, has led to an initial response to a fire that is structurally inadequate to prevent a major fire. This assessment should include the number and location of watchstanders.

h. Determine if USS MIAMI or the Shipyard prioritized production and schedule ahead of safety. Were warnings minimized or ignored in favor of progress?

i. Determine if the presence of Shipyard workers and a Shipyard fire department led to complacency and a reduced or shared sense of ship's force responsibility for maintaining safety in an industrial environment.

j. Determine if the absence of a prior serious submarine casualty led to an environment or mindset that concentrated too heavily on fire prevention and containment of small fires. Did this lead to a climate that effectively ruled out the possibility of a major casualty and created an environment where the crew and workers did not train and exercise to achieve proficiency for fighting a large fire.

k. Were opportunities missed to identify vulnerabilities for this casualty? Adapting a quote from the Space Shuttle COLUMBIA Accident Investigation Board, were the Shipyard and submarine crews "using previous success as a justification for accepting risk of a large fire?"

l. Determine if the requirements for the removal of submarine water tight doors or hatches and the requirements for quick disconnects for temporary service lines are adequate.

4. Your report shall include recommendations to address issues raised by your findings, including correcting deficiencies you identify. To the extent recommendations contained in the NAVSEA command investigation address deficiencies you identify, you may incorporate those recommendations by reference in your report. Similarly, you are also directed to make accountability recommendations relevant to any issues addressed beyond the scope of the NAVSEA command investigation. I shall forward any such recommendations to the relevant Commander for appropriate action.

5. Finally, the complexity of the repairs involved to restore USS MIAMI to full service and the involvement of multiple organizations necessary to execute those repairs require a high level of

Subj: USS MIAMI FIRE REVIEW PANEL

coordination and follow-up. You are directed to assess if the correct organizations have been brought together to restore the MIAMI as soon and as completely as possible. Additionally, you shall provide an independent repair planning and progress report to me every 30 days until I direct otherwise.

6. Senior panel members supporting your effort shall include (b) (6) (b) (6) (CNIC representative), (b) (6) (NAVSEA representative), and (b) (6) (SUBLANT representative). The appointment of these panel members has been coordinated with NAVSEA, CNIC and SUBLANT. In addition, these Commanders have agreed that their commands and their subordinate commands will fully cooperate with your review and provide support as required. (b) (6) is assigned to provide legal advice and support to the panel. Coordinate with the U.S. Fleet Forces Command Deputy Commander for Fleet Management and Chief of Staff for additional support requirements. Travel is authorized to the extent necessary to develop a detailed understanding of the issues surrounding the fire.

7. Conducting and leading this effort is your highest priority. To remain effective and retain the public's trust and confidence in our Navy, we must be able to identify and correct any institutional or systemic deficiencies that distract from our ability to provide mission ready forces when and where required. Your review of the USS MIAMI fire will be instrumental in fulfilling that mandate.

J. C. HARVEY, JR.

Copy to:
CNO
VCNO
Director, Naval Reactors
DNS
COMSUBLANT
COMNAVSEA
CNIC
(b) (6)

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5800
Ser N00/169

11 Sep 12

From: Commander, U.S. Fleet Forces Command
To: RADM Terry B. Kraft, U.S. Navy

Subj: USS MIAMI FIRE REVIEW PANEL

Ref: (a) COMUSFLTFORCOM ltr 5800 Ser N00/128

1. Reference (a) directed you to complete the USS MIAMI Fire Review Panel report not later than 60 days after you received a copy of the signed command investigation into the fire. You received a copy of the signed investigation on 26 July 2012, making 24 September 2012 the initial completion date for the report. Per your verbal request, you are granted an extension until Monday, 1 October 2012, to submit the Panel's report.

J. C. HARVEY, JR.

DEPARTMENT OF THE NAVY
COMMANDER
U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE SUITE 250
NORFOLK, VA 23551-2487

5800
Ser N00/180
20 Sep 12

From: Commander, U.S. Fleet Forces Command
To: (b) (6)

Subj: EXCUSED FROM DUTY ON USS MIAMI FIRE REVIEW PANEL

1. Effective immediately, you are hereby excused from your duty as a member of the USS MIAMI Fire Review Panel.

WILLIAM E. GORTNEY

Copy to:
RADM Kraft

APPENDIX I: ACRONYMS

AET	Aft Escape Trunk
AFFF	Aqueous Film Forming Foam
AMR	Auxiliary Machinery Room
ASW	Anti-submarine Warfare
AT/FP	Anti-terrorism/Force Protection
BDW	Below Decks Watch
BoD	Board of Directors
BOS	Base Operating Support
C2	Command and Control
CASCON	Casualty Control
CIA	Controlled Industrial Area
CNIC	Commander, Naval Installations Command
CNO	Chief of Naval Operations
CNRMA	Commander, Navy Region Mid-Atlantic
CO	Commanding Officer
COB	Chief of the Boat
COMSUBFOR	Commander, Submarine Forces
CONOPS	Concept of Operations
CSES	Combat Systems Electronic Space
CTSS	Continuing Training Support Software
DC	Damage Control
DCPO	Duty Chief Petty Officer
DDGOS	Deep Diving Submarine General Overhaul Specification
DISSUB	Disabled Submarine
DoD	Department of Defense
DoN	Department of the Navy
DONCAF	Department of the Navy Central Adjudication Facility
EAB	Emergency Air Breathing
ECC	Emergency Control Center
EDO	Engineering Duty Officer
EDPO	Engineering Duty Petty Officer
EM	Emergency Management
EOC	Emergency Operations Center
ER	Engine Room
ESAMS	Enterprise Safety Applications Management System
F&ES	Fire and Emergency Services
FC	Forward Compartment
FCLL	Forward Compartment Lower Level

FCML	Forward Compartment Middle Level
FCUL	Forward Compartment Upper Level
FD	Fire Department
FET	Forward Escape Trunk
FFE	Firefighting Ensemble
FITREP	Fitness Report
GMT	General Military Training
GSO	General Specification for Overhaul of Surface Ships
HAZMAT	Hazardous Material
IC	Incident Commander
ISIC	Immediate Superior in Command
LED	Light Emitting Diode
MOA	Memoranda of Agreement
NAVSAFCEN	Naval Safety Center
NAVSEA	Naval Sea Systems Command
NAWC-TSD	Naval Air Warfare Center – Training Systems Division
NCIS	Naval Criminal Investigative Service
NETC	Naval Education and Training Command
NFPA	National Fire Protection Association
NFTI	Naval Firefighter's Thermal Imager
NIMS	National Incident Management System
NNPP	Naval Nuclear Propulsion Program
NNSY	Norfolk Naval Shipyard
NRL	Naval Research Laboratory
NSR	NAVSEA Shipyard Representative
NSRO	NAVSEA Shipyard Representative Office
NSTM	NAVSHIPS Technical Manual
NWU	Navy Working Uniform
OJAG	Office of the Judge Advocate General
ONR	Office of Naval Research
OPNAV	Office of the Chief of Naval Operations
OSHA	Occupational Safety and Health Administration
PASS	Personal Alert Safety System
PEO	Program Executive Office
PHNSY	Pearl Harbor Naval Shipyard
PNSY	Portsmouth Naval Shipyard
PPE	Personal Protective Equipment
PSNS	Puget Sound Naval Shipyard
RF	Radio Frequency
ROC	Regional Operations Center
SCBA	Self-Contained Breathing Apparatus

SDO	Ship's Duty Officer
SEO	Shutdown Electrical Operator
SES	Senior Executive Service
SIR	Safety Investigation Report
SRW	Shutdown Roving Watch
SSORM	Standard Submarine Organization and Regulations Manual
SUBASE	Submarine Base
TR	Torpedo Room
TYCOM	Type Commander
USFF	U. S. Fleet Forces Command
WR	Wardroom
WRSR	Wardroom Stateroom
WSH	Weapons Shipping Hatch

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APPENDIX J: PERSONAL ACCOUNTABILITY RECOMMENDATIONS

Pursuant to the appointing order, the Panel provides the following discussion and recommendations regarding accountability in consideration of the facts and circumstances of the MIAMI fire.

Assessing accountability is complicated in the case of the MIAMI fire where the casualty was caused by a willful criminal act of a Government shipyard employee who had unsupervised access to the ship in the industrial environment. With very limited exceptions, the CO has absolute responsibility for the safety of his command including to implement safety precautions as required. Notwithstanding, a willful criminal act is not an accident. General safety precautions and other measures intended to prevent casualties in a shipyard industrial environment do not contemplate, and do not readily apply in cases of, acts of arson by shipyard employees. Although the specific motivations and intentions of the criminal suspect are not fully understood, his statement implies that he deliberately sought out and found a relatively secluded location with flammables present so that he could light the fire without being detected. This situation involving a willful criminal act is not analogous to a ship defending against attacks or criminal acts from outside. A ship that is deployed or pier side will have a heightened security posture in anticipation of outside threats. Such does not readily apply to the situation involving a ship in overhaul, which even under the best of circumstances will involve significantly diminished ship-maintained capabilities.

Although it remains subject to review and modification by endorsement, the JAGMAN basic report provided opinions and recommendations regarding accountability. Given that the opinions and recommendations are predecisional, it is not appropriate for the Panel to endorse these individually, but to independently address accountability matters within the relatively expanded scope of the Panel's investigation.

Individuals are subject to accountability if they are deficient in the performance of duties defined and ascribed by proper authority. Leaders of organizations or subdivisions within organizations are subject to accountability regarding the performance of their organizations relative to mission requirements.

(b) (5)

(b) (5) [redacted]

Regarding CO accountability, Article 0802 of Navy Regulations provides that "[t]he responsibility of the commanding officer is absolute, except . . . as provided otherwise in [Navy] regulations." It also states that "[t]he authority of the commanding officer is commensurate with his responsibility." Article 0825 further provides that commanding officers are responsible that "persons concerned are instructed and drilled in all applicable safety precautions and procedures. . . . In any instance where safety precautions have not been issued, or are incomplete, the commanding officer shall issue or augment such safety precautions as are deemed necessary, notifying, when appropriate, higher authorities concerned."

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5)

(b) (5)

(b) (5)

Although not considered material to the lack of effective firefighting response, the Panel identified other deficiencies when reviewing PNSY Fire Department records and procedures that merit additional inquiry. When questioned regarding firefighting training, the Fire Chief stated that his personnel had not conducted live fire training since 2006; however, review of ESAMS records indicate that PNSY Federal firefighters had completed live fire training in 2011 (b) (5)

(b) (5)

As part of its review, the Panel also investigated the actions within the NAVSEA and CNIC organizations regarding reports dating back to 2006 from the NAVSEA Shipyard Representative Office (NSRO) describing observations of ineffective integration of Federal firefighters with ship's force during fire drills conducted at PSNS (b) (5)

(b) (5)

(b) (5) [redacted]

(b) (5) [redacted]

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